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The Hydraulic Service Engine of the Pope Tube Company—II.

CONCLUSION.

Fig. 7 is a detail of the air chamber, which is of an unusual type, inasmuch as it contains a piston to keep the air and water apart. The tendency in all air chambers is for the water to gradually absorb the air, thus leading to the chamber becoming water-logged, and this tendency obviously increases with the pressure. With the heavy pressure under which these engines work, this action would lead to considerable annoyance and to stop, or at any rate reduce it, the air chamber is made cylindrical, and is bored out. A piston is then inserted, which, being packed with fibrous packing, will serve to keep the air and water apart. It will, so to speak, float on the water, rising and falling with fluctuations of pressure. At the same time absolute permanence of the air charge is not to be expected, and means are provided at the top for recharging when necessary.

Fig. 8 shows the water valves—both suction and discharge for the two are identical. These valves contain several unusual features, and this engraving is of corresponding interest. The valve seat will be seen to be inserted and to be held down in place by the conical ended pins *a*, while it is packed against leakage by the cupped leather *b*. By the aid of six webs it carries a central seat *c*, the opening being thus annular. From the seat *c* rises the guiding stem *d*, on which the valve slides as it opens, the stop *e* limiting its movement. The valve proper *f* is a ring and carries above it a second ring *g*, having four cross webs *h* cast in one with it, the sleeve *i*, also in one with *h*, surrounding the stem *d*. The sleeve *i* has a threaded cap *j* screwed down to a defined position, and serving on its lower side as a stop for the flange *k*, which is pressed upward against *j* by a strong spring *l*. The rock shaft *m* is the inner end of one of those shown in Figs. 4 and 6, and is the valve closing shaft. Two disks, one of which is seen at *n*, stand one each side of the valve stem *d*, their simultaneous action being secured by the connecting tie *o*, while each disk carries a pin *p*, which, when moving downward, acts on the flange *k* and closes the valve

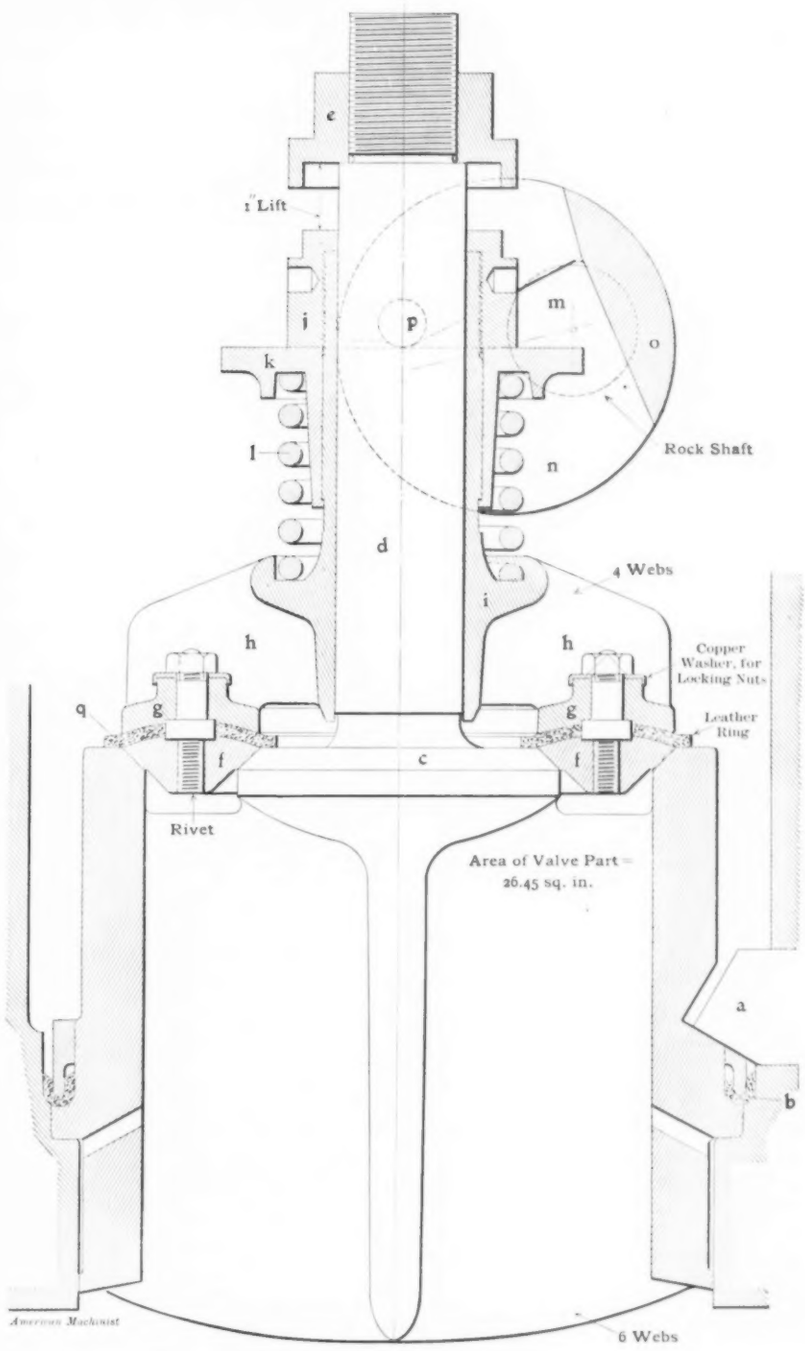

FIG. 8.—WATER VALVE.

through the medium of the spring *l*. At first sight there would appear to be still a spring action here, but in point of fact the spring is only a safeguard. It is of a strength sufficient to cause the flange *k* and the sleeve *i* and with them the valve, to move as one piece. The action is strictly mechanical, and the valve moves with the mechanism as though the spring were not there, *but* should a particle of

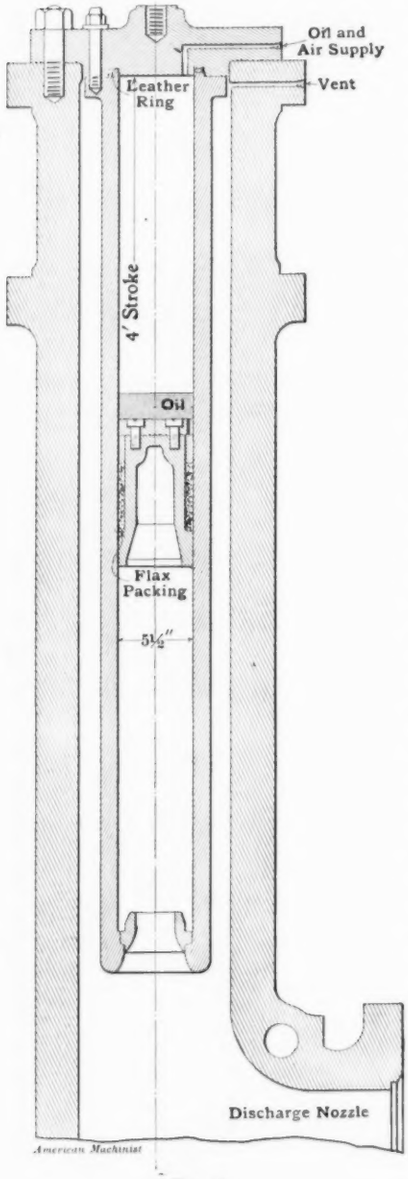

Fig. 7.

AIR CHAMBER.

dirt or other foreign substance lodge under the valve, and so prevent its seating, or should the valve be set wrong, during the trial adjustments, the spring would give way and prevent damage. It will be seen that in this valve a positive movement, with the whole power of the engine behind it, is provided to bring valve and seat to contact, and without the provision of the spring disaster might follow on slight causes.

Another feature of this valve, which is, we believe, novel, is seen in the leather ring *q* placed between the valve *f* and the ring *g*. The tendency of high pressure water to take adavntage of any slight leak through a valve and cut the valve and seat into channels is well known, and this leather ring is provided to stop it. The valve is not leather packed in the usual sense, in that it has a metal to metal joint, being in fact a perfect valve from usual standards without the leather ring, which simply serves to seal the joint and prevent the water from finding its way through any incipient leaks that may be present, and thus prevent grooving and channeling the valve and seat. It is, perhaps, uncertain whether this construction would work with spring pressed valves, because, as has been said, such valves are really closed by the currents of water, and the action of the water might turn the edges of the leather downward and so interfere with the seating of the valve. With the Riedler gear the valve is closed *against* the current, and the tendency would be to turn the leather backward rather than forward.

No one can see these engines in operation and note their smooth and noiseless running without being convinced that the theory of the pump valve gear is sound, while to those who cannot see them, especially those who are acquainted with the frantic oscillations often made by an indicator pencil when taking water cards, the cards given in Fig. 9 will furnish sufficient proof. To make still more clear the action of the valves, part of these cards have been taken with the air chamber full of water, the cards taken under these circumstances being indicated in the engraving. Of course, the ideal water card is a rectangle which will be seen to be practically realized in the card at thirty-six revolutions, and without air in the air chamber, while the cards at sixty revolutions, with the air chamber charged, show but a slight falling away from the ideal standard. These cards were taken at a pressure of 1,450 pounds per square inch, the scale of the spring being 1,000 pounds to the inch. The engravings are reduced from the originals, which were 3½ inches long, and, of course, the scale of pressures is correspondingly changed.

Fig. 10 shows the regulator and its connection with the accumulator. The cone pulley drive to the governor has been explained already, and is seen again in this figure. As originally laid out the plan was to have the belt shifter connected to the accumulator, so that the speed of the engines should be controlled by the position of the accumulator. This, however, was found to be unsatisfactory, since it led to constant "hunting" of the governor. Every momentary fluctuation in the work was immediately followed by a change in the position of the accumulator, and this in turn was reflected in a change in the speed of the engine. Of course, the very purpose of the accumulator is to provide for these momentary fluctuations, the proper speed of the engine being such as will represent the average work and keep the accumulator afloat. Constant hunting of the governor with the corresponding constant variations in the speed of the engine was, of

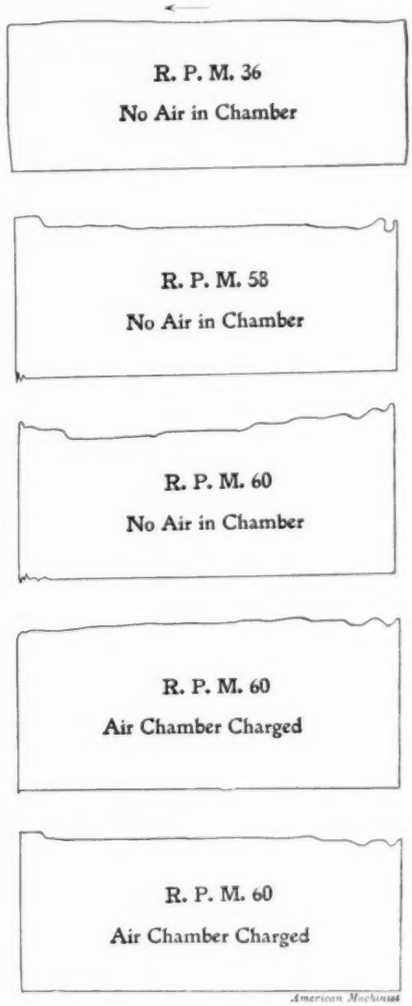

Fig. 9.

INDICATOR CARDS.

course, unsatisfactory, though the principal real annoyance grew out of the minor matter of wear of the belt. This was so serious as to make the belt a constant source of anxiety, and it finally led to the system being changed to that shown in Fig. 10. In this the belt shifter is disconnected from the accumulator and is placed under the control of the hand lever *a*. The engineer soon learns the speed necessary to provide for any given number of draw benches which may be at work, and he adjusts the hand lever to this speed or a little above it. A lug *b* on the accumulator embraces a stationary guide

rod *c* on which slides a collar *d* connected by a link and lever to a cam *e* turning about a center on the engine platform. Should the accumulator rise until lug *b* engages collar *d* the cam *e* will be turned and draw rod *f* to the left, which, through connections not shown, bodily lifts the governor balls and shortens the cut-off. Cam *e* in profile is composed of two circles of different diameters, connected by an inclined step, so that once the cut-off has been shortened the accumulator is free to rise without further action on the governor. This is necessary because the mechanism is so adjusted that under the shortened cut-off the engine shall just turn over. Again, the proportions of the parts are such that, with the lug *b* below the engaging point with collar *d*, the governor balls are entirely free from the mechanism described, and are free to act like those of an ordinary governor.

The accumulator for this plant is of very superior construction, and is shown in Fig. 11. The barrel *a* will be seen to be within the weight tank, which latter rests on a cast iron plate *b*. From this eight 3-inch rods *c* rise through pipes inserted in the tank to the suspending plate *d*. Plate *d* rests in turn on plate *e*, the weight being carried through the medium of springs, as shown. Plate *e* transfers the weight to the accumulator ram. The barrel *a* has four external ribs, as shown in section B B, which are turned. The hole through the bottom plate *b* is bored a sliding fit on these ribs, which thus form a guide for the weight tank, and prevent oscillation as it rises and falls.

It is desirable to be able to change the loading of the accumulator from time to time to suit the work, and, of course, on general principles a convenient means of filling and emptying it is desirable. The means provided will be seen at the lower left-hand corner of Fig. 11. The brass pipe *f* is connected to the lower end of the weight tank through the valve indicated at *g*. Pipe *f* slides through a stuffing box *h* into a well pipe *i*, which is shown broken off. Of two valves *j* and *k* one leads to the water supply and the other to the sewer, so that by properly manipulating the valves the tank may be filled or emptied and, if necessary, with the engines at work. The brass filling pipe *f* may also be seen at the extreme left of Fig. 2. The water connection to the accumulator cylinder and the spring stand to receive the tank at its lowest position are seen at the bottom of the plate. Just why the water connection has four nozzles—two of them being closed by blank flanges—we do not know. This figure may be studied with profit as a model drawing as well as showing a superior construction of accumulator.

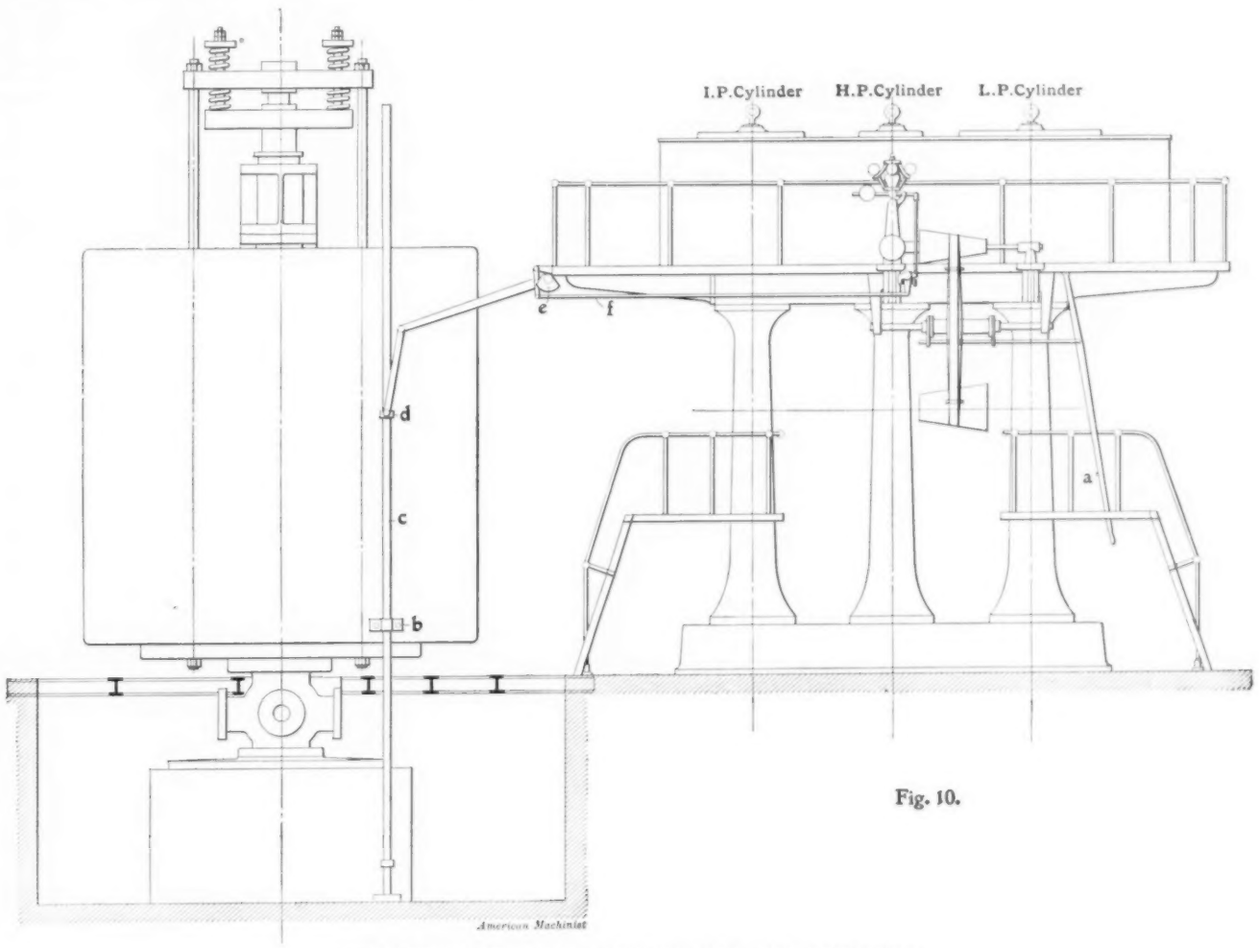

Fig. 10.

CONNECTION BETWEEN ACCUMULATOR AND GOVERNOR.

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The Rotation of the Earth and the Side Pressure of the Locomotive.

It is a fact long familiar to scientists that rivers running either northerly or southerly exhibit a tendency to crowd to the right. The right banks of such rivers, in a long average, wear away slightly faster than the left, and the river channels are also apt to be somewhat deeper toward the right bank. This is due to the rotation of the earth, the operation being evident to anyone who will give the matter a little thought. A locomotive and train running upon a north and south track must have this same tendency to crowd to the right, and as the speeds are so much greater than the flow of rivers, the tendency must be so much more pronounced. F. Koller, of Munich, has made some computations on this subject, and he finds that a locomotive weighing 88,000 pounds and running 45

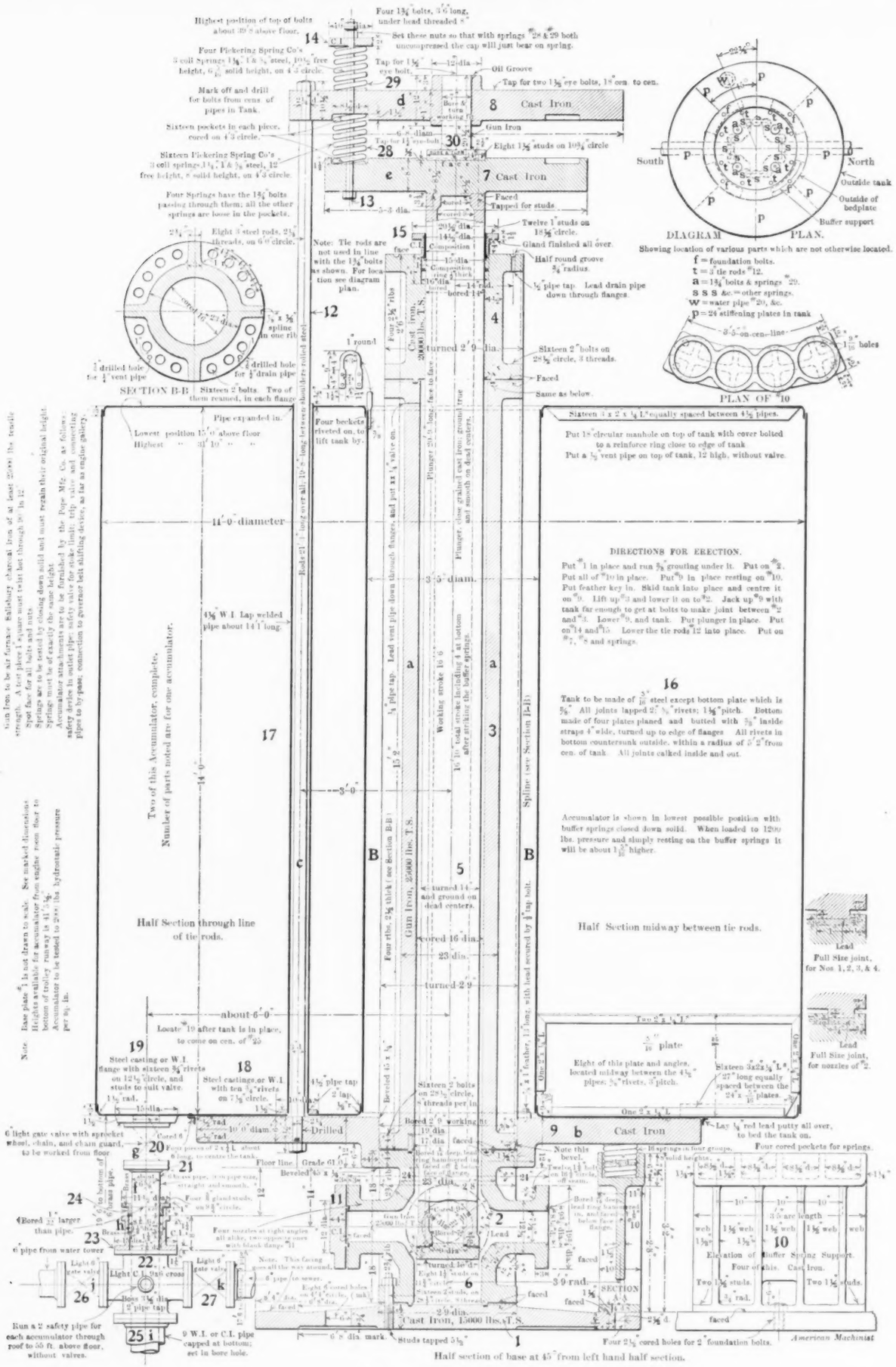
DIAGRAM
PLAN.
Showing location of various parts which are not otherwise located.
f = foundation bolts.
t = 3" tie rods #12.
a = 1¾" bolts & springs #29.
S S S &c. = other springs.
W = water pipe #20, &c.
p = 24" stiffening plates in tank
SECTION B-B
PLAN OF #10
Cast Iron
Gun Iron
Lead
Half Section through line of tie rods.
Half Section midway between tie rods.
Half section of base at 45° from left hand half section.
DIRECTIONS FOR ERECTION.
Put #1 in place and run ⅝" grouting under it. Put on #2. Put all of #10 in place. Put #9 in place resting on #10. Put feather key in. Skid tank into place and centre it on #9. Lift up #3 and lower it on to #2. Jack up #9 with tank far enough to get at bolts to make joint between #2 and #3. Lower #9, and tank. Put plunger in place. Put on #14 and #15. Lower the tie rods #12 into place. Put on #7, #8 and springs.
Tank to be made of 3/16" steel except bottom plate which is ⅝". All joints lapped 2" 5/16" rivets; 1⅝" pitch. Bottom made of four plates planed and butted with ⅝" inside straps 4" wide, turned up to edge of flanges. All rivets in bottom countersunk outside, within a radius of 5' 2" from cen. of tank. All joints caulked inside and out.
Accumulator is shown in lowest possible position with buffer springs closed down solid. When loaded to 1200 lbs. pressure and simply resting on the buffer springs it will be about 1 5/16" higher.
Two of this Accumulator, complete.
Number of parts noted are for one accumulator.
Note. Base plate #1 is not drawn to scale. See marked dimensions.
Heights available for accumulator from engine room floor to bottom of trolley runway is 41' 5⅝".
Accumulator to be tested to 2000 lbs. hydrostatic pressure per sq. in.
Run a 2" safety pipe for each accumulator through roof to 55 ft. above floor, without valves.
Full Size joint, for Nos. 1, 2, 3, & 4.
Full Size joint, for nozzles of #2.
Elevation of Buffer Spring Support. Four of this. Cast Iron.
American Machinist

FIG. 11.—ACCUMULATOR.

miles an hour, will have an excess of side pressure to the right of 150 pounds. The friction of the engine on the rails, however, causes a resistance to side movement of 13,000 pounds, so that no appreciable effect results from the side pressure, and practical railroad men are unable to discover any greater wear on one side more than another from this cause, and it is useless to look for any effect upon the track, at least on a single track road, as the locomotive when running in one direction will theoretically crowd to one rail and when running in the other direction will crowd the other rail.

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The Card Index System of Filing Notes and Clippings.

BY F. A. HALSEY.

As was remarked in a recent article in these columns on the Card Index System of Cost Keeping, the applications of the card index grow day by day, and it is found so satisfactory in these various applications that to-day the presumption is in its favor for almost any new use to which it is proposed to put it.

Many have wrestled with the problem of filing and indexing clippings from technical papers and notes of personal experience and with more or less, though usually less, satisfaction. A scrap book and a note book usually form the starting point, and they answer for a time. The pasting of a scrap book is a nuisance at best, but more serious is the fact that as the collection grows, and individual clippings lose their places in the mind, the necessity for indexing arises, and, the clippings being inserted in order of time, articles which belong together are naturally widely separated and eventually will be found in different volumes. The bulk soon gets formidable, and the chronic case of the article which is printed on both sides of the sheet is a constant annoyance. In the course of years much of the matter becomes commonplace, and would be removed if it could be, but this the paste forbids, and sooner or later the scrap book scheme, which was adopted as the obvious method, is found to be entirely inadequate. The note book has nearly all the drawbacks of the scrap book, though smaller in degree, because the number of notes is naturally less than the number of clippings.

This subject was up as one of those included in the topical discussions of the American Society of Mechanical Engineers some years ago, and various plans were described, which were of all degrees of elaboration up to those needing the services of a librarian to keep them in order. None of the plans suggested seemed to me equal to the one shown herewith, and as several inquiries for suggestions on the subject have come in to this office, this plan seems worth showing.

Many who have advanced beyond the scrap book stage use the plan of a series of envelopes, alphabetically marked and arranged, others use the bellows file, and still others a common letter file, while the portfolio scrap book has found some users; in fact, my own first attempt was with the portfolio scrap book and the present plan was adopted when it was found inadequate. The chief difficulty with any system of separate pockets or receptacles is that some of them soon get full to overflowing, while others are still nearly empty, and the full pockets have to be divided. If the pockets are attached together, as in the bellows file and portfolio scrap book, this upsets the alphabet provided by the maker. The old letters must be removed and new ones be attached, and this must be repeated whenever a pocket gets so full as to need dividing. The whole arrangement is thus in a constant state of transition and a permanent alphabet is never reached. When the file as a whole is full and a second one becomes necessary, the alphabet, as a whole, must be divided and again rewritten, one-half being given to each file, or, if this is not done, and each file has a complete alphabet, the two must be searched through whenever an article is wanted. Moreover, when a pocket has been divided it becomes necessary to search through two or more pockets for a needed article. All these plans have the further objection that they are not large enough. They answer after a fashion for small clippings, but a satisfactory file should take in magazine articles and pages from pamphlets, at least as large as the standard 6x9 page, without folding, and a large file like this is of great adavntage for large clippings, continued articles, and the like, as it reduces the amount of folding necessary. A large clipping or series of them folded to go into a small file is awkward. The letter file plan is better on these accounts, but has the objection of being limited in capacity.

CARD INDEX CASE FOR NOTES AND CLIPPINGS.

The accompanying illustration shows what was once on the market as a letter file, being called the Du Bois file. It never found favor with the public for its intended use, but is an ideal appliance for the present purpose, though I believe it is no longer offered for sale. This, however, is a small matter, as it can easily be made by a carpenter. It is simply a large card index box without the cards.

Partition cards with the alphabet printed on them as shown in the illustration go with it, and in place of the angle blocks at the ends of the usual card index box, a follower board is used having two sharpened wires and a thumb piece, by which the points of the wires may be thrust into the sides of the box. This enables the board to be pressed up against the contents of the box, and held there, so that the clippings soon get pressed flat and lose their tendency to open out.

In use the articles which it is desired to preserve are simply clipped out, and, to insure uniform size, are folded over a piece of stiff pasteboard kept in the box for that purpose. A letter is written at the title of the article to indicate the letter under which it is to be indexed, the clipping is dropped into place, and that is all there is of it. The index letter on the clipping is necessary to insure that the clippings will be replaced where they belong at some future time when they are consulted. Many articles may be indexed under several heads, and unless the index letter is used an article is sure to be dropped into the wrong place some time in future.

In connection with this box I have a supply of stiff double ruled paper, cut to the size to which the clippings are folded, on which the notes which formerly went into a note book are written, and then dropped into place among the clippings—the box being thus at once a scrap book and a note book. In the case of small clippings, which are apt to get down in the bottom of the box under foot of the others, so to speak, I paste them on these cards, and so make them hold up their heads and maintain uniform size among the contents of the box.

If the matter under a given letter becomes so bulky as to make further division desirable, it is easy to add subdivision cards so that the A space is divided into two, the first running from say Aa to Al, and the second from Am to Az, and this process may be carried as far as desired. Another plan of subdivision is to insert subdivision cards for special subjects. Thus, under B may be a subdivision for Boilers, under C one for Chimneys, under E one for Engines, and so on, and obviously both methods of subdivision may be, and in a large collection should be, used together. As the collection grows and the box gets crowded, it is only necessary to provide a new box and transfer half the alphabet to it, the plan thus being indefinitely expansible and yet always in ship-shape.

Now please note the advantages of this method. First, the articles on any given subject are together. Second, except for the small clippings already mentioned, there is no pasting. Third, when, as is often the case, an article may be equally well indexed under several heads, it may be placed under one and then be cross indexed by cards containing the title of the article and a reference to the place where it may be found, and dropped in place under the other heads. Fourth, except for this and the writing of the index letter, there is no indexing involved. Fifth, the article printed on both sides of the sheet offers no difficulty. Sixth, the occasional case where an article is printed on the back side of another is easily met by dropping a card in the division for the second article with its title and the inscription—"See back of article on * * * indexed under division X." Seventh, notes and clippings, are kept together. Eighth, articles may be removed and taken to the shop if desired and dead matter may be weeded out. Ninth, references to articles not clipped may be indexed on the cards, and references to books by chapter and page may be indexed in the same way; in fact, in addition to being a file of notes and clippings the box is also an index rerum, a sort of universal knowledge box so to speak. Tenth, indefinite subdivision is possible. Eleventh, there is no limit to the degree of expansion of a collection. Twelfth, bulk and waste room are reduced to a minimum; in fact, the capacity of such a box is astonishing. If any other plan offers so many adantages I am not aware of it.

As already stated the size of the box should be such as to take in the standard 6x9 inch page. Unfortunately my own box dates from the time when there was no standard size of page and it is too small (5x8 inches). A convenient length of box is 12 or 14 inches. In starting such

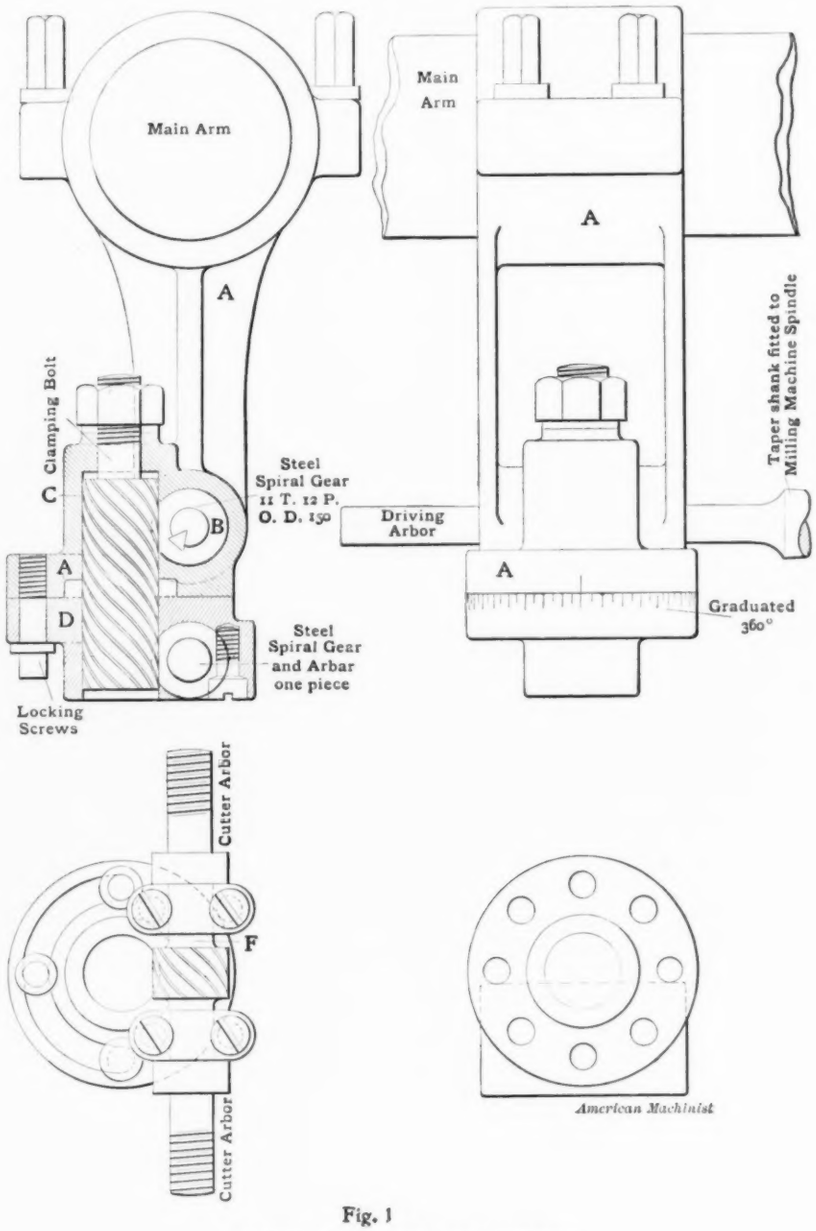

Fig. 1

A HELICAL MILLING ATTACHMENT.

a collection the plans should be such as to involve a minimum of labor or it will not be kept up. This condemns any system involving much pasting. No unnecessary trimming should be done. A clipping should never be notched down to a title below the top of a column, or notched up to the end of an article which does not finish a column. Such trimmed articles are more easily torn and do not fold as neatly as those having all columns left full. The margin of a newspaper page should be left on, as on its two sides it usually carries the name and date of the paper from which it came, and this may be useful to know at some future time.

Of the value which one sets on such a collection as time goes on, it is impossible to speak too highly. In case of fire I am free to say that, after the family was looked out for, my box of notes and clippings would receive first attention. The insurance money would replace other things, but not this.

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A Helical Milling Attachment.

We are enabled to illustrate an interesting and recently devised attachment for the milling machine which adds to the range of its adaptability. The attachment is primarily designed for use in cutting helical gears. The gear to be cut is mounted on the horizontal spindle of the usual spiral attachment of the milling machine, receiving the required simultaneous rotation and lineal advance from it. The usual practice is to use the gear cutter upon the regular spindle of the milling machine and to swing around to the required angle the spiral attachment upon which the gear which is to be cut is mounted. The peculiarity of the present arrangement is that whatever the angle to which the gear is to be cut the spiral head remains parallel with the slide, precisely as in straight milling, the required relative angle of the cutter to the work being secured by swinging the cutter around.

The cut Fig. 1 will enable the device to be easily understood. The vertical bracket *A* is clamped to the overhanging arm of the milling machine, being capable of being slid in or out for adjustment as required. Bearings are provided for steadying the driving arbor, which is fitted to the taper hole of the machine spindle and extends out as long as may be required. The small helical gear or pinion *B* slides upon this arbor. The triangular spline shown is secured to the pinion, a corresponding groove being cut in the arbor. This pinion works into the upper end of the long vertical helical gear *C*, causing it to revolve. The arbor *F*, which carries the cutter, is double ended, so that the cutter may be secured on either end, as may be most convenient. A helical gear made solid on the middle of the arbor works into the lower end of the vertical helical gear and is driven by it. The upright gear revolves upon a pin or stud in the bracket *A*. The cutter arbor is carried in a separate piece *D*, which is swiveled to be turned around the axis of *C* and to be clamped at any angle by the screws shown. The axis of the cutter arbor is thus always equidistant from the axis of the vertical gear, and the gears are always in correct mesh. The angle required for the cutter is usually known by computation, the graduations upon the periphery of the lower member *D*, enabling it to be set with precision. After the cutter is set to the required angle the bracket is slid in or out upon the main arm until the center of the cutter is over the center of the arbor which carries the gear to be cut, and is then clamped in that position. In the sketch shown all the gears are of the same diameter and have the same number of teeth, so that the cutter revolves at the same speed as the machine spindle. There is no limit to the angle at which the cutter may be placed. If swung around 90 degrees it is ready for rack cutting and is used for that purpose. The device is evidently equally ready for any helical milling work, for milling cutters, reamers and other tools as well as for gears.

The half-tone, Fig. 2, shows an interesting model, all the gears upon which have been produced by the use of the above attachment. The horizontal shafts, with the hand crank on the near end, carries six gears, all of the same diameter, and all having teeth cut with the same cutter or the teeth being all of the same pitch. The model shows how the worm, so called, is simply a toothed gear as truly as any other. On this shaft the gear at the farther end has 24 teeth, the next 15 teeth, the next 8, then successively 4, 2 and 1. If the one toothed wheel is not a gear, where is the line to be drawn between worm and gear? The gears on the vertical studs which are driven by those on the horizontal shaft have successively, beginning at the farther end, 24 30, 32, 32, 32 and 32 teeth. When the shaft is turned 32 times the nearest vertical gear makes one turn, the next two turns and so on successively doubling, the last gear making 32 turns the same as the horizontal shaft.

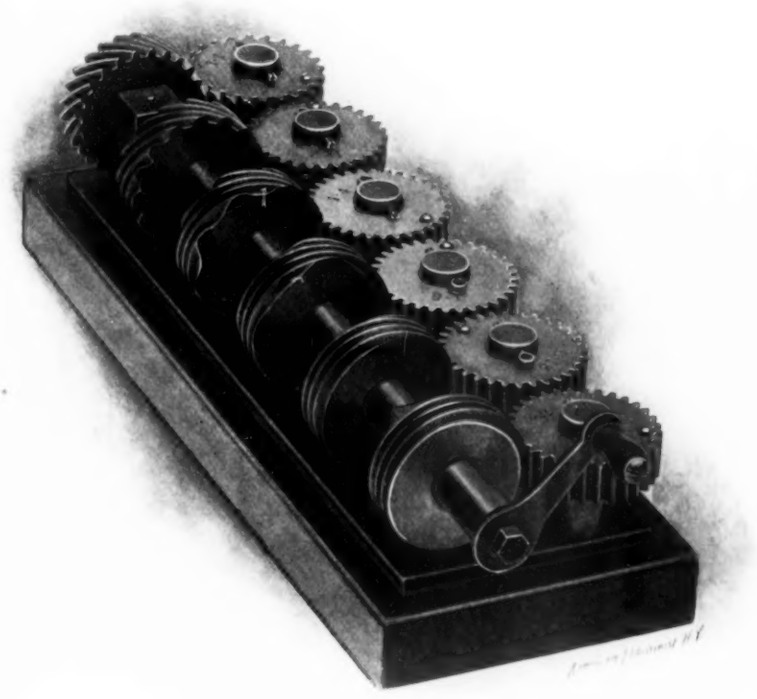

FIG. 2.—MODEL OF HELICAL GEARS OF VARIOUS RATIOS.

This attachment is made by the Arthur Company, 188 and 190 Front street, New York city.

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We have received from the General Electric Company a small pamphlet giving an account of some tests designed to show the depreciation of candle power of Welsbach mantles. The primary object of this is, of course, to show that electric lighting is better and more economical than the best known methods of gas lighting, and the tests certainly show what to many will be a surprisingly rapid deterioration of light giving power in mantles. Those who have had experience with them will not be so much surprised.

Cost of Electric Power.

A valuable paper presented at the recent Boston meeting of the American Street Railway Association was that by R. W. Conant entitled, "Cost of Electric Power for Street Railways at the Switchboard, Both Steam and Water Power." The paper had to do with the records of forty-four power stations of electric railways in different cities. Its full scope is indicated in the following paragraph:

"The total cost of operation for the production of power alone from these stations during the past year has been $1,825,000 and if the power had been produced by all at as low a cost as it was in a number of the more economicnl stations the saving for the year would have amounted to $443,300. It is the chief purpose of this paper to explain the 'if,' and to obtain some idea of its size."

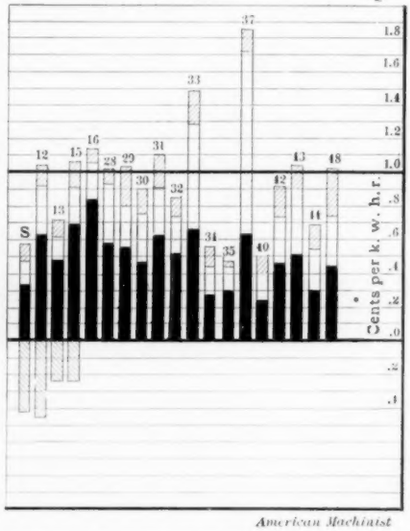
The "if" is very fully and clearly shown in the paper, which is much too long for reproduction in our columns. The most suggestive detail of the paper is the accompanying diagram, which shows the difference in cost of power at the switchboards per kilowatt hour at different stations. The first part of the paper was devoted to the description of an imaginary, but easily possible, plant, which is taken as a standard for comparison. The first column in the diagram represents this standard. In all the columns the heavy black portion indicates coal; the white, labor; the shaded portion at the top, general expenses, and the shaded portion below, the fixed charges. The horizontal lines across the diagram indicate each one-tenth of a cent cost per kilowatt hour. The kilowatt, it is convenient to remind ourselves, is 1.34 horse-power. The explanatory comments on the various results exhibited and the conditions which caused them are appended, in part.

Station No. 12. This plant is about a third the size of standard. It does not feed in with other stations. Its generators are belted to three tandem compound condensing engines which operate under steam pressure of 110 pounds. It has water tube boilers averaging four years of service, heaters, but no economizers. A good quality of bituminous coal is used, which costs $2.93 per ton. By reference to the table it will be seen that this station produced power to the extent of 23 per cent. of its capacity during the past year, at 1.49 cents per kilowatt hour, including fixed charges. The operating expenses alone amounted to a little over 1 cent. The total cost of operation for the year was $23,000, of which $13,610 was for coal. Water costs this station nothing and the labor was about one-half the coal bill. It will be seen that the coal and labor are both much higher than standard, and if standard performance had been reached a saving of $10,000 would have been made in the operating expenses for the year.

Station No. 13 is an interesting combination of cheap coal, simple non-condensing engines direct connected to the generators, together with a high load factor. Its capacity is 70 per cent. of the standard, major part being three 800-kilowatt generators, the smaller unit is 200-kilowatt. It produced power to the extent of 42 per cent. of its capacity at .96 cents per kilowatt hour, inclusive of depreciation and fixed charges.

The diagram shows labor for this station to be equal to standard, principally on account of high load factor; the other differences are also apparent. It is interesting to note that the road operated by this power station used on an average about 1.3 kilowatt hour per car mile. Total car miles for the year was 7,207,308, about 10 per cent. of this mileage being trail cars.

Plant No. 15 in an interesting example of what a multiplicity of units will do for



American Machinist

COST OF ELECTRIC POWER AT DIFFERENT STATIONS.

labor, the figure being 6.3 men per 1,000 kilowatts. The effect of this would be much more apparent on the diagram were it not for the high load factor and low rate of pay.

Plant No. 16 is of 600 kilowatts capacity. The cost for power for past year was $53,000. Load factor is the same as standard. Standard operates to produce about double the output for the same figure.

Station No. 28 is 1,400 kilowatts capacity, has slow speed condensing engines, heaters and economizers. The feed water leaves economizer at the high temperature of 158 degrees. The engines are simple belted to the generators, and coal costs but $1.63 per ton.

Plant No. 29 is a compound condensing slow speed belted station of 1,900 kilowatts capacity and feeds in with another station. The coal costs $3.86.

No. 32 is a combination of two power houses feeding into the same system. These stations are interesting because these costs are for the past year, and since then these two stations, as well as smaller ones operated by the same company, have been consolidated into a large water power plant, from which power is transmitted at 13,000 volts. The two steam stations shown in column 32 have five triple expansion condensing engines. This road operated on about 1.4 kilowatts hour per car mile. The coal costs $3 per ton.

Station No. 33 has rather a tall column, due principally to its low load factor of 16 per cent.

Station No. 34, operated at a lower cost than standard on account of the high load factor 57 per cent. reducing the cost of labor and low price of coal $1 per ton.

No. 35 is a plant of 1,200 kilowatts capacity, interesting on account of the fact that it has but one unit. It operates with 2.1 men per 1,000 kilowatts, a load factor of 37 per cent. coal, costing $1.24 per ton. Its costs are quite a little lower than standard.

No. 37 is a record breaker in the opposite sense. It is of slightly greater capacity than No. 35, but has three engines and eleven generators, which require eight men per 1,000 kilowatts capacity. It has a load factor of but 11 per cent. during 151 days, from January 1 to May 31, 1898. The effect of this on the cost of labor is very apparent.

No. 40 has a capacity of 9,200 kilowatts. It is direct connected, has economizers and compound condensing engines. Anthracite coal is burned, costing $1.60 per ton. This plant operates at less than standard figures.

No. 42 is a belted plant, compound non-condensing engines, heaters, but no economizers. It has a good load factor, but the effect of the belted and small units shows in all three items.

No. 43 is a combination of alternating and direct current apparatus. It has a low load factor of 15 per cent., the effect of which is noticed on the labor.

No. 44 is a 6,000 kilowatts station, and, although belted, has large compound condensing engines and economizers, which with coal at $1.60, brings the cost of fuel below standard figures.

▲ ▲ ▲

Machine Tools for Indian Artisans.

Readers of the "American Machinist" whose best thoughts are given to refinements of costly mechanism, whereby cheap goods are to be produced, have not much time to think of the millions of artisans for whom their most perfect appliances are utterly unsuitable. These artisans may be numbered by millions in India alone—men who never possessed a foot rule or knew what it is to own a properly sharpened hand saw. They will make boards by cutting a pine trunk in lengths of about 6 feet, splitting it skill-

fully with wedges and trimming the slabs with a small adze. This is the fashion all through the Himalayas. Iron is still made by a process thousands of years old, and at the present day within 60 miles of Simla the smith may be seen at work upon a stone anvil. Many of the tools and cutting implements are of iron hardened by cold hammering. Much taste is displayed in the carving in stone and wood upon the houses of these people, and particularly upon their temples, a deep fringe of wooden tassels, which swing in the wind, being a favorite ornament.

From $3 to $4 a month is a high average pay for the Indian artisan. Out of this he must provide for his family and find his own kit of tools. He will never buy a tool that he can possibly do without, his saws are always out of order because of the cost of saw files and oil, and he does not yet realize that to work quickly and correctly he must increase his appliances and economize labor. Should he become a master the tools he previously used are good enough for his men, and, as a rule, he can neither read nor write.

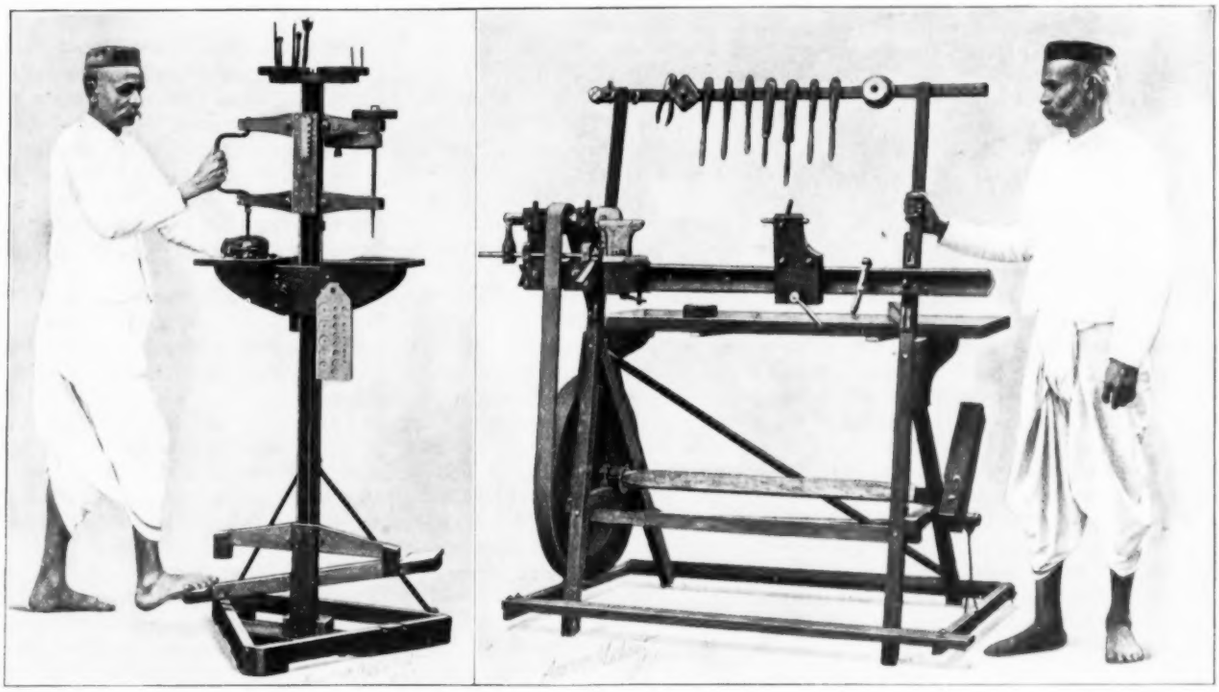
If the artisan could write he would probably want to leave his trade and become a clerk. This gives a position of dignity, however bad the pay may be. The Indian Government has a large project for the technical instruction of the Indian artisan, so that he may become more efficient and reliable; this scheme hangs fire, principally on account of the cost of fitting out schools in sufficient number, according to English notions, with English machines and tools.

It has already been observed in mission schools that, although Indian boys may become expert with European or American tools, they fall back as soon as they leave on the very inadequate native kit. Although the workshops of the railways, docks, arsenals, mills and foundries are of necessity furnished with European tools, down to the hand tools of the smith and carpenter, which all belong to the workshop, the training they afford has little influence on the methods of the great majority of workers, who will only use such tools as they can buy cheaply or make for themselves, and thus the laborious system of slovenly work at a minimum rate of pay continues. It is not unusual in Lucknow to see cross-cut saws made, by hammering, out of old locomotive or carriage spring plates.

It appeared to the editor of the Indian "Textile Journal," after many years of observation of the native workman, that his advancement by means of schools can only be effected on a much less ambitious scale than that contemplated by the Government. The instruction should supply only what he needs most, and this is clearly a better knowledge of the *art* of his work. The *science* of it may very well wait for several generations. The country is already well provided with schools for training masters; but that is the thick end of the educational wedge, and as the art of acquiring knowledge is totally different from that of imparting it, the college bred men have, so far, left no mark of their influence on the artisans they eventually commanded. In Europe it was from the ranks of the best workmen that the masters were for ages recruited, and the crafts had reached a very high pitch of excellence long before reading and writing were found necessary for the artificer.

It seems that in spite of the influence of its contact with Western civilization, which has so revolutionized the cotton industry, India has still to pass through a period of modern machinery and appliances, for the simple reason that the great majority of the people can neither appreciate nor afford anything better.

With a view to the fitting up of district schools for wood and light brass work the editor of the "Indian Textile Journal" designed the lathe and drill press shown in the accompanying illustrations. The lathe bed is a straight angle bar, to which the headstock is bolted. The tailstock is clamped to the bed by a plate fitting over the bedplate, and a sliding saddle carries the hand rest. Screws are cut with a single point tool which receives its traverse movement from a type-metal die engaging in the screw of a collar on the tail end of the mandrel. It is thrown in and out of gear by the left hand of the workman. The bed being attached by slotted brackets to the frame may be adjusted to the hight of boys or men. The fly-wheel, shaft, bearings and crank pins are all of hardwood, for which castor oil is found to be an excellent lubricant. The frame is put together with rivets and washers.



LATHE AND DRILL PRESS FOR INDIAN WORKMEN.

A 6-inch circular saw, with adjustable table, is also provided.

No appreciable wear has been observed on the mandrel or any of the other bearings after six months' work.

An angle bar forms the pillar of the drill press, upon which is a sliding head carrying on one side a hand brace and on the other a small drill. The feed is applied by the foot from either end of a foot lever. A stop-motion is provided to regulate the depth of holes, and another device will space holes in a line without measurement. These tools are now in use in the workshop of the School of Art, Bombay, where they are found useful for joinery and cabinet work. They are typical of numerous other labor-saving appliances that may be made almost entirely out of the hardwoods that are so plentiful in India, and they may be regarded as a first step toward method and precision in work and a higher class of labor-saving tools. J. W.

Bombay, India.

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True Fuel Economy of Locomotives.*

BY ROBERT QUAYLE.

Many students of the steam engine are interested in the performance of the locomotive as a heat motor and peruse carefully the figures for the coal and water consumption obtained by elaborate tests, and are gratified to note the economy obtained as the result of gradual improvement in design. The motive power official may possess his share of sentiment, and certainly should be alive to all improvements that will increase the economy of the locomotive as a heat engine, but he must also look upon his motive power from a far more business-like standpoint. He must consider the locomotive as a machine—a tool created for a purpose—representing a large investment of capital and costing annually a considerable sum for its operation, and must be deeply concerned in making it give the largest possible return to the company. If to attain this end he must violate, in the construction or operation of the engine, principles which he knows tend toward economy of water and fuel, it is his business to do it. And I have no hesitation in saying that to the carrying out of this wise and business-like policy are due some features of locomotive practice that are sometimes condemned by those who are apt to look upon the subject entirely from the standpoint of economy in fuel.

Perhaps I can best illustrate this business problem by a comparison which every motive power official has had to make at some time, in connection with the rating of his engines. The tests that have been made upon the locomotive in the testing laboratory of this university demonstrate that the most economical point of cut-off is between one-quarter and one-third of the stroke. Other tests made on this same plant show that as the locomotive boiler is forced and the rate of combustion increased, the rate of evaporation falls off rapidly. The conclusion is therefore warranted that with a given speed a cut-off later than one-third of the stroke will result in a loss of economy, both in the boiler and the cylinders. Are we, therefore, waranted in endeavoring to operate our locomotives under these conditions of maximum fuel economy? The work of the engine varies so much with the grades that we cannot expect to run at a uniform rate of cut-off; but is it economy to endeavor to give the locomotive such a load that it will average one-quarter to one-third cut-off? Let us look into the question. Suppose ours is a 19-inch engine in freight service on a hilly division, and that under a limitation of the average cut-off to one-third the tonnage which it can haul over the division is 600 tons, exclusive of its own weight and that of the waycar. Let us further assume that if the engine is worked to its utmost capacity on the ruling grades, even if by so doing we must run it for many miles at from one-half to full stroke, we will be able to haul 750 tons. The train and engine crews' wages will amount to about 13.2 cents per mile or $13.20 per 100 miles. When hauling the heavier train we are getting 25 per cent. more tonnage over the division for the same cost of wages, and thereby effecting a saving of $3.30 for each 100 miles the 750 tons are hauled. This is a clear gain in operating expenses. Now, let us look at the actual consumption of fuel, and in doing this we must bear in mind that while our nominal weights of trains are 600 and 750 tons, respectively, the real weights, allowing 100 tons for the engine and tender and 15 tons for the waycar, are 715 and 865 tons, respectively. Evidently the weights of the engine, tender and waycar form a fixed quantity in our calculations, and that the heavier the train the less the percentage of the total work of the engine needed to overcome their resistance, and the internal resistance of the engine. Evidently the coal consumption in our comparison should be figured on the basis of the tonnage of the cars and their contents only, for upon this is based the earnings of the train. For the 600 ton train the coal consumption may be taken at, say, 17 pounds of coal per 100 ton miles, or 10,200 pounds to haul the train 100 miles. For the 750 ton train the consumption per 100 ton miles will be about 1½ pound less, or say 15.5 pounds per 100 ton miles. In other words, the lesser percentage of the total work of the engine expended upon itself, its tender and the waycar, more than offsets the increased consumption of coal per indicated horse-power. The total consumption for the 750 tons hauled 100 miles will be about 11,625 pounds. Thus, while the total consumption of coal per trip is of course greater for the heavier train, the consumption per 100 ton miles is less; consequently the fuel bill to haul 3,000 tons of cars and contents will be less if it is taken over the road in four trains of 750 tons instead of five trains of 600 tons. So we have saved money in both wages and fuel per 100 ton miles. But the question is broader still. Evidently fewer engines, resulting in a lesser investment, are required; furthermore, while the cost of repairs per mile run by the engine may be greater, the cost per 100 ton miles of train hauled will be less. Again, the fewer engines will mean a smaller investment in roundhouses, shops, machinery, etc., and last, but not least, the operating expenses will be reduced in more ways than train crew wages, and the liability of accident will be lessened by the fewer number of trains. Thus the broader the light in which this question is viewed the greater the economy of working the locomotive beyond the point of maximum economy per indicated horse-power.

That this view of this business problem is correct will be conceded by every motive power official. The situation may appear to you to be paradoxical, particularly in regard to the item of fuel, but that coal can be saved by loading an engine heavily we have proof of daily. The road with which the writer is connected keeps an individual coal record by which the consumption of coal per 100 ton miles by each engineer is recorded. In a group of men in comparable freight serivce on one division the best performance in November last was 15.9 pounds per 100 ton miles, the engineer having an average train of 853 tons. The poorest record was 28.7 pounds, but the average train was only 378 tons. Of course there are differences in engines, which was true in this case, but all our coal accounts support the statement that, other things being equal, the heavier the train the less the consumption per 100 ton miles. The limit to this rule is not reached before the engine is so overloaded that the required time cannot be made. So evident is this to our engineers that they are anxious to haul the heaviest trains of which their engines are capable, as by this means only will their records compare favorably with others in the same class of work.

This same mode of reasoning, by which the work of the engine is viewed by its effect upon the net cost of hauling tonnage rather than its economy in fuel per horse-power, must apply to other questions involved in locomotive construction and operation. On this basis

* Extracts from a lecture at Purdue University on "The Business Problems of the Motive Power Department."

the size of locomotives has been constantly increasing and will continue to increase. Anything which adds to the economy of performance, but limits the amount of work that can be obtained from the engine, either by reducing the tonnage it can haul per trip or reducing the mileage it can make per year, cannot hope to succeed. If a complicated valve gear would save 5 or 10 per cent. in fuel, but would cause the engine to miss a trip occasionally because of repairs necessary to the mechanism, the loss of the service of the engine to the company in busy seasons would possibly more than offset the saving in fuel. On the other hand, simple, strong and reliable construction of the locomotive, facilities for quickly repairing it, and everything that will add to its useful mileage per year, is worthy of careful study. At the same time the necessity of meeting these conditions does not relieve the motive power official of getting the greatest possible economy out of the locomotive as an engine, after he has met the conditions noted, and if he does his whole duty he will be eager enough, in his attempt to obtain this economy, to satisfy the most enthusiastic student of the steam engine.

* * * * * * *

Statistics are usually so uninteresting that I have made but little use of them this evening. Properly kept they are, however, of great value. By their use the business of the department can be grasped in its entirety. But in order that they should not mislead, they must not only be accurate, but must be on the right basis. In the past nearly all of the statistical work of the department has been computed on the engine-mile basis. In many respects this is most undesirable, as the engine-mile is far from being a constant unit. The ton-mile is a much better basis for much of our statistical work. Already we have placed all our coal records on this basis, and it is probably only a question of time when repairs and supplies will be computed in like manner. The importance of this matter is nicely illustrated in our coal records. On the engine-mile basis the engineer who hauled the lightest train made the finest showing, other things being equal. On the ton-mile basis the man who hauls the heaviest train may expect to have the best record. Thus we furnish an incentive to actual economy of operation, instead of putting a premium on extravagance. Furthermore, you can readily see that if we had not considered the ton-miles we would not have seen any economy in fuel in our 750 ton train, as compared with a 600 ton train, in our example of engine rating. The value of the ton-mile statistics are also illustrated by the records heavy modern power is making on many roads. When these engines are first put in service the men find they burn a large amount of coal per mile run, and use more oil than the smaller engines. Computing their fuel supplies and repairs on the ton-mile basis, however, the performance is seen to be a wonderful improvement over the smaller engines, and fully justifies their use on divisions whose business is heavy enough to properly utilize them. It will be clear upon reflection that the statistics on the ton-mile basis would determine the true cost for a unit of work; and furthermore, as this unit is also a fairly accurate measure of the value of the service rendered the company, we are able at all times to determine with a fair degree of accuracy the cost of the locomotive performance per unit of revenue producing service.

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The White Star Liner Oceanic.

In the steadily increasing size of ocean-going steamships the Great Eastern has at last been surpassed in length, though not in tonnage. The Oceanic, now building by Harlan & Wolff for the White Star line, is 704 feet long, with a tonnage of 17,000, while her developed horsepower is expected to exceed 40,000; these figures for the Great Eastern being 682 length, 18,900 tonnage and 7,660 horsepower. The Oceanic is expected to be able to cross the Atlantic in four and a half days and to consume 700 tons of coal per day. The following table, for which we are indebted to "The Practical Engineer," gives particulars of some ships which were leaders in their day, and shows how far in advance of her time the Great Eastern was:

	Tonnage.	Length in Feet.	Breadth in Feet.	Horse Power.
Great Eastern...	18,900	682	82	7,650
Britannic.....	5,000	455	46	5,500
Arizona	5,150	450	45	6,300
City of Rome....	8,000	545	52	11,890
Alaska.....	6,400	500	50	10,500
Servia.....	8,500	515	52	10 300
Umbria.....	7,700	501	57	14,320
City of Paris....	10,500	560	63	18,500
Teutonic.....	9,600	582	57½	18,000
Campania.....	12,950	620	65	30,000
Kaiser Wilhelm..	14,000	649	66	30,000
Oceanic	17,000	704	....	....

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An Unappreciated Draftsman.

An interesting discussion of the status of the draftsman in British shops is now current in the columns of the "Engineer," London. The following letter, whether *bona fide* or not, is worth reading:

THE POSITION OF DRAFTSMEN.

SIR—I have followed the correspondence going on in your columns on the above subject with much interest. Not only are we draftsmen underpaid for our work, but we are constantly subject to blame for things that go wrong in the shops. Our drawings during their progress are subject to petty criticisms from the boss or the works manager or the chief draftsman.

Once I had got out the drawings for some machinery involving a long train of wheels, when the works manager came along and told me to put in what he called a "hunting cog," and said "I ought to have known that." Of course I had to rearrange all the centers, and it took me a long time, and I got blamed by the chief draftsman. Not long after I was sent down to the rail mill to take particulars of an old shears and punching press that had broken down, and was told to make the wheels stronger. I found there was no "hunting cog" in the gears, of which the big wheel drove the shears arm off a crank pin fastened in the wheel, and the pinion shaft worked an eccentric for the punch. Of course I put the works manager's "hunting cog" in for him, and when the machine got to work, that works manager came in and laid it on to me because the machine hadn't made more than twenty or thirty revolutions before the arm for the shear jaw and the eccentric came together and broke everything up.

I could tell you many things that have happened to me that I am no more to blame for than that.

I often think I should have done better to stay at the vise. I was always a steady and well conducted young man, and in the shops now there is the man I worked next to—a rough tongued, slap-dash sort of fellow—taking away his two pound ten a week, while I only get thirty-five shillings, and no prospect of more.

How men get selected for promotion from the drawing office, too, beats me. There is one man who was taken away by an old pupil for a works manager job, and I hear he has dropped into clover. I could never see anything in him myself. You never heard anything about the jobs he was on in the office, while there is the man who worked opposite to him, and who is a really clever man—why, for instance, he can cut the end off his desk with his hand and make a noise that you would swear was a cross-cut saw going through it—he never gets the chance of a works manager's job; instead of that he comes in for a "rowing" from the chief draftsman now and again.

Well, sir, I hope we shall soon get better paid. It's all nonsense to talk about not staying in a drawing office if you can get anything else better to do. Everyone knows that the really difficult part of the work is done in the drawing office, and the rest of the works has only to carry it out. So I think that in time, as this comes to be recognized, we shall get better pay.

AN OPPRESSED DRAFTSMAN.

October 5.

Letters from Practical Men.

Universally Incorrect Indicator Practice.

Editor American Machinist:

While Mr. Swift, in his letter under this title in your issue of September 15, is entirely correct in his statements regarding the necessity of combining pairs of indicator cards to obtain the net pressure on piston at any instant, I think he underestimates the proportion of engineers who understand this and who habitually use the knowledge when considering matters in which this point is of importance. I am not acquainted with the text-books used in most of the engineering schools, but the subject is clearly explained in Professor Klein's "The High Speed Steam Engine." This work is the text-book in use by all students of mechanical engineering at Lehigh University, and having some experience of the way in which it is taught, I think every student at that school understands it. There is no reason to suppose that the many other first-class schools are less thorough. Turning to a more elementary book ("The Steam Engine," by George C. V. Holmes, text-books of science series), I find the following, under the heading "Effective Pressures on Piston":

"The indicator diagram, though it shows the pressure at every point of the stroke, does not show the pressure which is available for transmission through the piston and connecting rods to the crank of the engine. This pressure is the difference between the total pressure, as shown by the diagram, on the driving side of the piston, and the simultaneous back pressure on the other side of the piston, which latter can only be obtained by taking a separate diagram from the other end of the cylinder," etc.

Perhaps the most elementary in its methods of all the institutions for engineering instruction is the International Correspondence Schools, of Scranton, Pa. Its teachers employ no higher mathematics and its students are mainly among the engineers and others who work with their hands in the daytime; yet these students are taught this subject in the same detail. In the first few pages of their instruction book on indicators and indicator cards I find a clear figure of a pair of superimposed cards, with text explaining carefully how to get the net pressure on the piston by subtracting from the total forward pressure the opposing pressure on the other side. These are the only works on the steam engine which happen to be at hand, but it seems to me they are sufficient to indicate that the theory of indicator cards is more generally and more correctly taught than Mr. Swift supposes.

Perhaps the real reason for the general use by engineers of the single indicator cards, without combination, is that this method gives an accurate estimate of the power represented by the cards, and that no further refinement is of any use unless the effect of the inertia of the reciprocating parts is also taken into account; because the neglect of this inertia force in estimating effective pressures on crank pin introduces an error so large as to make the computations almost useless.

To illustrate this effect I will take the left-hand end of the card shown in Fig. 1 of Mr. Swift's article. In his Fig. 7 he shows (see Fig. 2 of this article) the net steam pressures actually existing on the piston. But these pressures are not transmitted unchanged to the crank pin—a

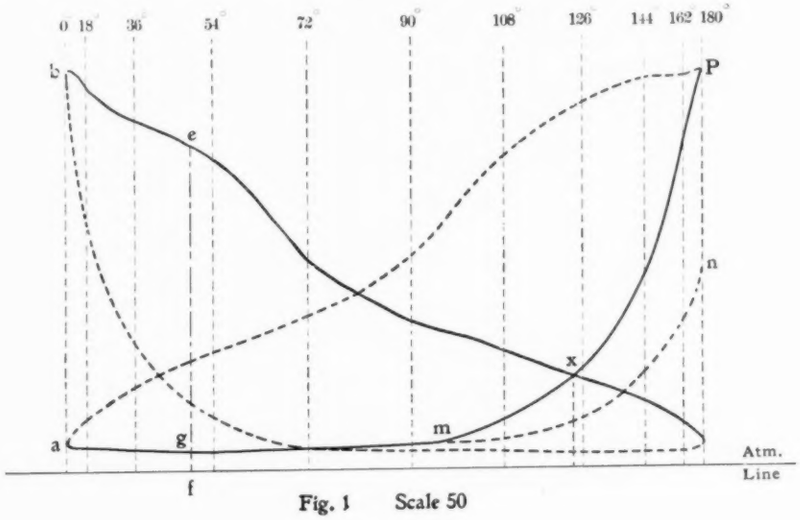

Fig. 1 Scale 50

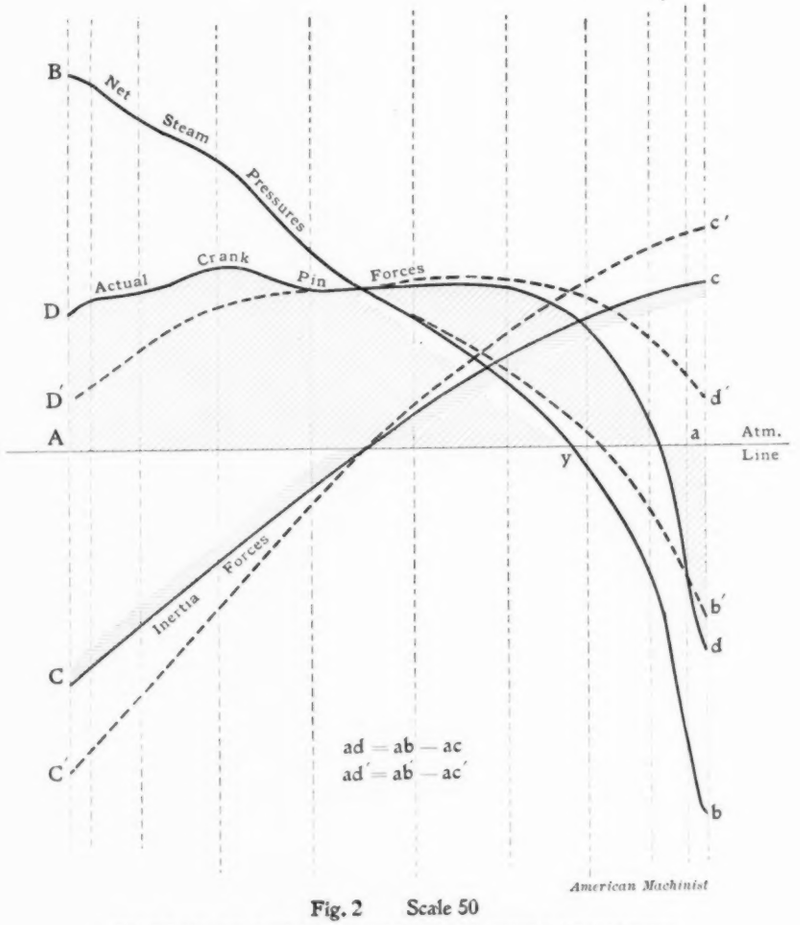

Fig. 2 Scale 50

DIAGRAM OF ROTATIVE FORCES OF THE LOCOMOTIVE.

point which is not always given the attention it deserves. The reciprocating parts of the engine—the piston, piston rod, crosshead, connecting rod and side rod—must be started from rest at the beginning of the stroke and gradually accelerated to a maximum speed near mid-stroke. This takes a large force at the beginning, gradually decreasing to zero; which force is supplied by the steam pressure if that is sufficient, and if not, by the fly-wheel. During the latter half of the stroke the same parts are gradually brought to a standstill, and in the process they press against the crank pin, which receives during this half stroke not only the full steam pressure, but also the pressure necessary to stop the reciprocating parts.

I do not know the weight of the reciprocating parts of this locomotive, but for illustration it will be near enough to assume 1,200 pounds. If this mass were attached directly to the crank pin and revolved at 187 r. p. m., its centrifugal force would be about 14,300 pounds, acting radially. At each end of the stroke this mass does act radially on the pin (in line with the cylinder axis) with a force of more than 14,300 pounds at the beginning, and less than 14,300 pounds at end, of the stroke, the variations being due to angularity of rod. At other points of the stroke the acceleration is not so great, hence the force of the parts pushing or dragging on the pin is less. The process of finding these pressures is given in Klein's "High Speed Steam Engine," resulting in the formula

$$F = (\cos w + \frac{R}{L} \cos 2w)\ Fo$$

in which

Fo = Centrifugal force of whole mass of reciprocating parts, if concentrated at crank pin.

w = Crank angle = O at beginning of stroke.

$\frac{R}{L}$ = Ratio of crank length to connecting length.

F = Actual pressure of reciprocating parts against crank pin, due to acceleration.

In our case, Fo = 14,300 pounds. To illustrate the application of the formula, especially the care necessary to use correct signs for the cosines, let us find the accelerating force for 50° crank angle, and $\frac{R}{L} = \frac{1}{6}$.

$$\cos 50° = \quad .6428$$

$$\frac{1}{6} \cos 100° = \frac{1}{6} (-.1736) = -.0289$$

$$(\cos w + \frac{R}{L} \cos 2w) = \quad +.6139$$

Hence

$$F = .6139\ (14300) = 8778 \text{ lbs.}$$

In order to compare this pressure with the steam pressure on the indicator cards it is necessary to divide it by the area of the piston, thus reducing it to pounds per square inch—thus 8,778 pounds on the 18-inch piston (area 255 square inches) is 34.4 pounds per square inch. This is the pressure per square inch of piston required to accelerate the reciprocating parts at 50 degrees crank angle, corresponding to .2 stroke, or about .71 inch from left-hand end of this indicator card, which is 3.54 inches long, scale 50. At this point the total steam pressure is 91 pounds per square inch (= $c\ f$, Fig. 1), and the back pressure is 4.5 pounds (= $f\ g$), leaving 86.5 pounds net pressure. But of this 34.4 pounds is absorbed by the moving parts, leaving only 52.1 pounds actually transmitted to crank pin. This shows a material diminution of the pressure on crank pin near the beginning of stroke. The same computation and measurements for 130 degrees crank angle, or .8 stroke, are as follows:

$$\cos 130° \ (= -\cos 50°) = \quad -.6428$$

$$\frac{1}{6} \cos 260° \ (= \frac{1}{6} (-\cos 80°)) = -.0289$$

$$\cos w + \frac{R}{L} \cos 2w = \quad -.6717$$

$$F = (-.6717)\ 14300 = -9605 \text{ lbs.}$$

The minus sign indicates that the acceleration force is negative—that is, that the moving parts are giving out work, instead of absorbing it. Hence the pressure due to this 9,605 pounds, which is 37.7 pounds per square inch, must be *added* to the net steam pressure existing at crank position 130 degrees. This net pressure is zero, as it happens to be at the point x, Fig. 1, where forward and back pressure lines cross. Adding this 37.7 pounds to this zero pressure leaves a respectable margin of forward pressure where the indicator card shows a reversal. (See curve of net steam pressures at y, Fig. 2.)

Carrying out this process for eleven crank positions at intervals of 18 degrees gives the results tabulated below:

Crank Angle.	Fraction of Stroke.	Acceleration Force (lbs.).	Accel. Force Per Sq. Inch of Piston.
0°	0	16650	65.4
18°	.0285	15510	60.8
36°	.110	12300	48.3
54°	.233	7660	30.1
72°	.383	2485	9.8
90°	.542	−2380	−9.4
108°	.692	−6340	−24.9
126°	.821	−9160	−36.0
144°	.919	−10820	−42.5
162°	.979	−11660	−45.7
180°	1.000	−11900	−46.7

These results and their effect on the actual crank pin pressures are graphically shown in Fig. 2, in which the curve of net steam pressures is the same as in Mr. Swift's Fig. 7, showing a high forward pressure during the first part of stroke and a counter pressure nearly as high at the end. The influence of inertia is plotted to the same scale in the curve $A\ C\ c\ a$. The curve $A\ D\ d\ a$ is the combination of these two, showing an almost uniform crank pin pressure during a large part of the stroke, with the reversed pressure at end much diminished, but not entirely overcome. The compression in this card is excessive, considered in the light of stationary practice, where it would be avoidable.

In order to illustrate the convenience and usefulness of this inertia curve let us suppose this to be a stationary engine and that we are at liberty to change the speed and the compression. Assume that the actual pressures on the crank pin should be such that there are no reversals of pressure during the stroke. To overcome the negative pressure $a\ d$ at end of stroke we can either increase the inertia ordinate $a\ c$ by increasing the velocity, or we can reduce the compression, or both. The available increase of inertia is limited, becauses it *reduces* the crank pin pressures at the beginning of the stroke and may introduce a reversal there. The amount $D\ D'$ (25 pounds) is about all that can be safely deducted from the net intial pressure $A\ D$. This reduction is to be accomplished by increasing the engine speed and thereby the inertia, as it is not desirable to decrease the steam pressure. Hence the inertia curve is to start at C', making $C\ C' = 25$ pounds. To find the engine speed to accomplish this we need only remember that inertia forces increase as the square of the velocity, that the original velocity is 187 rotations per minute, the original inertia force $A\ C$ is 65.4 pounds and the new inertia force is to be 65.4 + 25 = 90.4 pounds. Call the velocity x.

Then $x^2 : 187^2 = 90.4 : 65.4$

$$x = \sqrt{\frac{187^2 \times 90.4}{65.4}} = 187 \sqrt{\frac{90.4}{65.4}}$$

= 220 r. p. m.

This determines a new inertia curve, roughly shown by the dotted line $C'\ c'$. It is computed and plotted exactly as previously shown, except that instead of the centrifugal force 14,300 pounds we use the centrifugal force of the same weight at the new velocity, which is about 19,800 pounds. The increase of inertia force at the end of stroke is $c\ c' = 17.8$ pounds.

Let us now assume that the curve of actual crank pin forces should not fall below d' at end of stroke. To accomplish this the actual terminal pressure must be increased about 68 pounds (= $d\ d'$). We have just seen that we can only get about 18 pounds by increasing the inertia forces. The remainder must be made up by reducing the compression 50 pounds, which makes the compression curve like $m\ n$, Fig. 1, instead of $m\ x\ p$. This 50 pounds is represented by $b\ b'$, Fig. 2, and the curve of net steam pressures will follow the partly dotted line $B\ b'$. Then

$b\ b' + c\ c' = d\ d'$, raising the end of the curve of actual crank pin forces to d'. If plotted the general character of this curve will be found similar to dotted line $D'\ d'$. in which the bad features of the original curve $D\ d$ are eliminated.

To those not familiar with this method a few trials will demonstrate its convenience and value. It will often serve to throw light on the cause of knocking, and if applied to engines in course of design may be used to harmonize the weight of reciprocating parts with the proposed speed and compression curves. It sometimes happens that a quick running engine with heavy moving parts will actually have a double reversal of pressure near the beginning of the stroke, due to the accelerating forces absorbing the whole initial pressure of the steam, and more. This would be the case with this locomotive when run at a speed of about 250 revolutions per minute, or over.

WALTER FERRIS.

▲ ▲ ▲

Incorrect Indicator Practice.

Editor American Machinist:

If anyone is better qualified or more fully authorized to write about "incorrect indicator practice" than myself I want to know it, for I have succeeded in perpetrating one of the most incorrect specimens of such practice that it is possible to conceive of. We all know what an execrable thing is plagiarism, and what a detestable wretch a plagiarist is. Well, that is just what I am. In my letter entitled "Universally Incorrect Indicator Practice," which appeared in the "American Machinist" of September 15, I wrote that "None of the various books on the indicator, as far as I know, had shown the correct way of getting the actual effective or net pressure acting to drive the piston at all points of the stroke, although the diagram can readily be made to do so." Now this statement was not true. I did know all the while that this had been fully explained by one of the greatest of authorities on the steam engine indicator, but I didn't know that I knew it. I bought, and I was an enthusiastic reader of, Mr. Charles T. Porter's great book on the indicator when it first appeared, and that book, in its chapter on "The real diagram, and how to construct it," went over the whole matter clearly and completely. I read every word of the book with high appreciation, and I have no doubt that much of the contents of it stuck to me, and this about the true diagram evidently did.

It happened that Mr. Porter's book went out of my possession, and only since writing the letter referred to in the "American Machinist" have I again seen a copy of it, which copy of course convicts me at once of being a plagiarist, which is several degrees higher than a plain, ordinary, every-day thief.

How, as I said, the Porter indicator book went out of my possession is worth noting just at this time. It happened that just when I was full of the book I was an intimate shopmate of Frank Hemenway, who has just died, and of course I could not help talking about it, and of course, also, I loaned him the book. About the same time he loaned me "Ewbank's Hydraulics," and although no word was ever spoken about it after, I have no doubt that it was regarded tacitly on both sides, as it certainly was on mine, a fair and permanent exchange of books. The Porter book undoubtedly went where it did the most good, and it has always been a matter of satisfaction to me that I was probably instrumental in promoting Hemenway's active interest in the steam engine indicator, upon which he later became a respected authority.

Apart from the unpleasant flavor of plagiarism, I do not regret having stirred up this subject, as it undoubtedly will call the attention of many to what is under certain conditions of considerable importance.

TECUMSEH SWIFT.

▲ ▲ ▲

A Ball Milling Job—A Tool Steel Experience.

Editor American Machinist:

We have a ball joint to make which is shown sufficiently to be understood in Figs. 1 and 2. *C C C C* are the points of bearing; *B* is a sliding piece operated by the wedge *D*. We first made it with a cutter the size of the ball (—.002 inch, to allow for grinding), feeding in the slide *B* with a wedge and allowing the cutter to float. With this method we found it impossible to get the lengths alike, owing to variations in the castings and in the hardness of the iron.

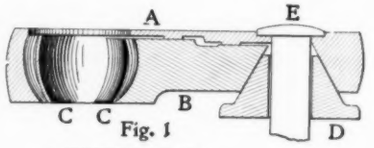

Fig. 1

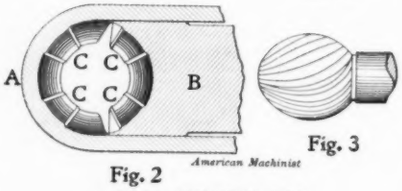

Fig. 2

Fig. 3

A BALL MILLING JOB.

We made the cutter, Fig. 3, which does the job nicely. The cutter has a curve radius on the cutting edge the same as that of the ball, but it is made small enough in diameter to allow it to enter through the top of the casting. With a jig to locate the sliding piece *B* and the rotary milling table it is plain sailing.

The tool, Fig. 4, cut the teeth in the cutter very nicely. It consists of the cast iron piece *A*, with a shank turned to fit the milling machine spindle and the cutter *B*. *B* is adjustable and held by the wedge and screw *C* and *D*. On account of the four points of bearing to be milled the objection to a straight toothed cutter is obvious. After a little experimenting with the table angle you can cut a tooth that will sufficiently approach a spiral for all practical purposes.

After we made our cutter then came the "etcs." It was made of a well-known brand of American annealed tool steel. After it was finished it would not harden. We sent it to the steel makers with instructions to wire at once if they could harden it. After waiting several days we wired for an answer. This is the answer:

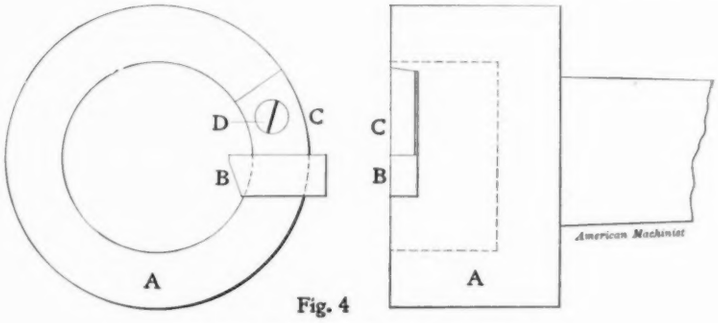

Fig. 4

RIG FOR GROOVING THE CUTTER.

"BLANKSBURG.

"—— Co., Rochester, N. Y.:

"We have cutter in laboratory; will write early next week.

"—— STEEL CO."

We wired them a hot one, demanding an answer. Then we received this:

"BLANKSBURG.

"—— Co., Rochester, N. Y.:

"Will harden cutter and return in a few days. —— STEEL CO."

After another wait we received the cutter. Hard? Aye! but about as useful for the purpose for which it was designed as a well seasoned corn cob. Then to add insult to injury they told us that we had overheated the steel and that we could not expect a bar of annealed steel to harden clear to the outside, as there is always a decarbonized scale to some depth on the outside that will not harden; also that the cutter

hardened at a good red heat in brine. There can be no doubt about the cutter having got the "good red heat" in the laboratory.

This is no new story and I suppose one familiar to most tool-makers. Why we should continue to put up with it I do not see. I know it is nice to have steel that "works like cheese," but I have seen a lot of expensive tools lost in this same way. I have seen experts sent on to make good a bluff like this one and spoil tools to the amount of a couple of hundred dollars before the demonstration was completed. I think it would be better for all concerned if a manufacturer would acknowledge his errors, as we have to, and allow us to retain some confidence in him. We cannot expect that a steel maker will not sometimes over-anneal a bar, but when he does so he should be willing to make it good.

If a customer wrote us that he had a short-circuited armature, and we told him that he must be using current that had knots or sand in it, and wore the insulation through, he might think we were lying. I think it would sound about as reasonable as the explanation we received about the steel.

W. A. WARMAN.

Rochester, N. Y.

▲ ▲ ▲

An Improvised Power Driven Hack-Saw—Applications of the Micrometer.

Editor American Machinist:

Having a large number of pieces of bar steel to cut off and no way on hand to do it, except either in the shaper or by a hand hack-saw, I made a rig for the purpose.

At the back and a little to the right of our shaper is an old drill press, on which was clamped a milling machine vise to hold the work, using a piece of 1x 1½ inch iron, bent into the proper shape to take a 12-inch saw blade, this frame was attached to the back end of the shaper ram by a hardwood arm, with a stud on which it would swing freely. The saw frame was weighted so as to give the proper feed, and when the piece was cut off the saw would drop about half an inch onto a strip of iron and run on a roll until stopped. This rig worked well.

Reading some time ago in the "American Machinist" about using the back or barrel end of the micrometer for truing up the lathe, I have since been using the same thing for planing work quickly and right to size. The work to be planed is finished on one side and turned over and the other side planed almost to size. Then without raising or lowering the tool the micrometer is clamped to the side of the tool, and the back end of the micrometer screw is run down to touch the work. The work is taken off and its thickness measured in thousandths of an inch, and put back again. The micrometer spindle is run back as many thousandths as are required to be taken off the work, the tool is lowered until the micrometer touches, and another cut is then run over the piece with this adjustment of the tool, and the work is finished. This will give very good results when done right. I find that the back end of the micrometer spindle may be used in many ways. When clamped to the ways of the lathe, work can be faced up within .001 of an inch, which is very useful in making milling machine cutters and other close work.

M. J. L.

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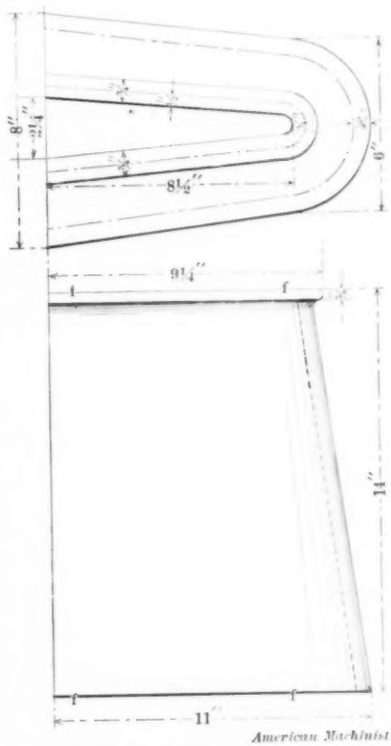
Pounding Block for Arbors, Etc.

Editor American Machinist:

Inclosed you will find a sketch of a pounding block used in driving mandrels in and out of work.

I saw it used in the toolroom of a bicycle shop—an idea of the foreman's.

It at once recommends itself on account of its simplicity and cheapness, being nothing but a rough casting, as shown, finished on top and bottom.



POUNDING BLOCK FOR THE BENCH.

The greatest expense would, of course, be in making the pattern, from which, when once made, any number of castings could be obtained.

Hoping you may think this sufficiently interesting to publish, I remain,

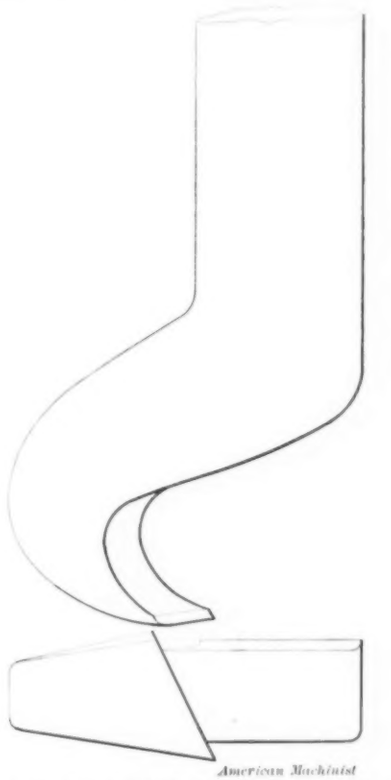
P. S. BUSHNELL.

Cleveland, Ohio.

A Planer Tool for Sharp Corners.

Editor American Machinist:

I send you a sketch of a planer finishing tool that I have found to be a good one, as it will not break the sharp corners and makes filing them first unnecessary. I guess that almost any planer hand has experienced having the corners crack off when using a straight faced, square nosed tool. That was caused by the edge of the tool coming to the end of the cut all at once. This style of a tool, as will be seen by the end view at the bottom of the sketch, comes out to the end of the cut on an angle. The tool should be fed with its low side first, so as to prevent it pulling in, as it would be likely to do if fed the other way on a cut that was a little heavy.



A PLANER TOOL THAT WILL NOT BREAK THE CORNERS.

There is a little, and sometimes a good deal, in knowing how to sharpen a tool for real light finishing scrapes. A tool should not be rubbed too much with an oil stone, as it is likely to round the fine edge. I have found that if the edge were left a little bit raw it would cut cleaner, and was not as apt to slide over the work and whistle as soon. The tool should be ground straight (as it is not very easy to rub straight); then it should be rubbed just enough to make a fine bright line on the under side of its cutting edge. This tool can be used for finishing wrought iron or steel with a big feed, and it won't tear it.

HARRY L. CAMERON.

Cincinnati, Ohio.

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The Report of Engineer Melville.

The annual report of Commodore Melville, of the Bureau of Engineering, is one of great interest and importance, as it could not fail to be at this time. It comes very promptly upon the close of our recent naval activity, while the interest in that line is still alert, and the expectations and wishes of the audience which it addresses are happily and very fully met. As the war which has just ended was the first in which modern steam vessels have had a thorough trial and exhibition of their capabilities, the report very properly summarizes the important lessons to be derived from our actual experience. It insists upon the vital necessity of frequent tests of all machinery under actual working conditions, and upon the great importance of having naval stations properly fitted for repairs and with adequate supplies of stores. Key West and its necessities in this regard are specially insisted upon. A distilling ship is an important adjunct of a fleet, as fresh water is now almost as necessary as coal. A repair ship also is so necessary that several should be always ready. Attention is called to the great tactical advantages of water tube boilers. Three screws with separate engines are recommended in preference to two screws with two sets of engines to each, as with the New York and the Brooklyn. There should be frequent trials under forced draft, which on some of the ships had actually never been used until the chase at Santiago. The location of the forced draft apparatus is a matter of great importance. Some of the present arrangements are as bad as they can be in this respect, the blowers being so placed that their surroundings are too hot for human endurance. A large increase of the personnel is very necessary, especially in view of the increase in the numbers of ships. In case of war we have no means of replacing those disabled by the casualties and vicissitudes which are inevitable. Provision must be made for training the enlisted men of the engineer department. Many colliers and auxiliary vessels last summer went out with green crews, many of whom had actually never been to sea before. Our fighting ships must have the highest practical speed.

The report says that there was a remarkable absence of casualty in the machinery departments of the vessels of the fighting squadron during the war, which "is as fine commentary upon the personnel as on the machinery."

The torpedo boats did not make a good record. "It is a sad affair that nearly every one has had some accidents, and the machinery of some at the close of the war was in a condition that can only be described as horrible, where boilers were burnt, cylinder covers broken, pistons and valves stuck, and everything in bad shape." They were used for services for which they were not designed. They are intended for high speed spurts, and for this they should be solely kept. The engineer-in-chief includes in his report a very strong recommendation for the passage of the personnel bill now pending in Congress. We hope later to be able to give a more adequate presentation of this admirable report.

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The Numerous Factors in Practical Economy.

We have no doubt that the extracts from the lecture of Robert Quayle, which we print elsewhere in this issue, under the title of the "True Fuel Economy of the Locomotive," will be read with interest and appreciation by our readers. We have here clearly shown and emphasized for us the important fact that practical economy is different from ideal, or, as we usually say it, theoretical economy. Ultimate fuel economy will never be found by those who study only the fuel, or, in the case of fuel economy on the railroad, by those who do not look beyond the locomotive. Before the end is reached the whole business of the road, and even its history from the beginning, so far as that history is embodied in its fixed charges, will be found to have to do with it. The final statement of fuel economy must be with "all things considered," and the emphasis upon the "all" can scarcely be too heavy.

Economy in fuel, as in everything else, is secured by compromise, although even the word compromise is here more or less misleading. The thing accomplished is the attaining of a large and all embracing average, and the compromises or sacrifices at certain points are only the details of the larger operation. It is well and proper to ascertain, by experiment or by deduction, the precise conditions under which in the locomotive the greatest amount of work may be done for a given unit of fuel. When this is found out, it will then follow that loads either greater or less than this will show a diminished economy, and either should be avoided. This avoidance is the precise thing which, in railroad practice, is most impossible. Every condition which goes to determine the load is a variable one. The weight of the train, the grade, the speed, the weather conditions, are constantly differing, and the combinations of them also differ, the changes in one particular being often in one direction when those of another will have a reverse effect, and then vice versa. The conditions such as we have cited are usually not lost sight of when seeking to solve the problem of the economy of fuel; but, after all, economy of fuel is not the ultimate end sought in the profitable operation of a railroad. There are other economies that might, either of them, as well be made the central idea of economy, such as economy of labor, economy in repairs, economy in cost of rolling stock and others such as these. Neither can be absolutely secured without a sacrifice of one or more of the others. The economy which Mr. Quayle leads up to is not that of fuel alone, but the all comprehensive economy which results in the greatest ultimate profit, and this he clearly shows may involve the sacrifice of various economies in detail, the economy of fuel as well as others. He shows, as most men in business realize, that a judicious and not unreasonable crowding of things is profitable even if a little more coal is burnt.

It has seemed to us for a long time that the question of fuel economy of compound locomotives was regarded from altogether too narrow a standpoint. It is natural of course in making tests to compare the fuel burned in hauling the same weight of train. To say that the compound locomotive can develop the same power as a simple engine with a smaller consumption of steam or coal is equivalent to saying that it can develop more power when consuming the same amount, and however roundabout may be the road traversed, we have no doubt that in the end the compound locomotive will not be found to burn less coal than the older engines, but to haul heavier trains. The results arrived at by the lecturer, and especially the method by which they are reached, are worth bearing in mind for

other applications. While economy of fuel or of power is of great importance it is not always of the greatest importance, and there is perhaps at times a tendency to forget the proportions of things. The question of street car traction has, perhaps, been argued more upon the basis of power economy than it deserves to be. The gas or gasolene motor can perhaps show a better fuel economy than any other, with the added great advantage of independence of the power house, yet there is no immediate promise of its adoption. The systems which seem to be now prevailing are winning upon their merits, which are those of all around adaptability much more than of fuel economy alone.

▲ ▲ ▲

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(100) C. S., Cincinnati, says: (1) Please give a rule for finding the radius of an arc when the length of the chord and the distance from the chord to the arc are given. A.—In Fig. 1, let

a = one-half the chord;
b = the hight of the arc;
c = the desired radius;
d = the distance from center of arc to chord.

Then obviously,

$$c^2 = a^2 + d^2.$$

Or, since

$$d = c - b,$$
$$c^2 = a^2 + (c - b)^2$$
$$= a^2 + c^2 - 2cb + b^2,$$

which reduces to

$$2cb = a^2 + b^2$$

or

$$c = \frac{a^2}{2b} + \frac{b}{2}$$

that is: Divide the square of half the chord by twice the hight, and to the result add half the hight; the result will be the desired radius. The problem may be easily solved graphically. In the last equation let the value of the first fraction be called e, that is, let

$$\frac{a^2}{2b} = e,$$

or

$$\frac{a\,a}{2b} = e,$$

from which

$$\frac{a}{2b} = \frac{e}{a}$$

This is now a simple proportion, of which the only unknown term is e, and any problem in simple proportion may be solved by similar triangles as in Fig. 2, in which lay off on the base line a length equal to $2b$ and at its extremity draw the first perpendicular, equal in length to a. Also lay off a on the base line and draw the second perpendicular. The length of this perpendicular as cut off by the base line and the diagonal is equal to e, since, obviously,

$$\frac{a}{2b} = \frac{e}{a}$$

To this add $\frac{1}{2}\ b$, as at the bottom, and the sum of e and $\frac{1}{2}\ b$ will be the desired value of c, the radius. (2.) In making a square center the angle of the center desired in the shaft is 90°. At what angle must the sides of the square center be to each other? A.—Suppose the center to be capped by a cone which just fits the edges, as in Fig. 3. It is necessary to find the value of $a\ b$ in order to obtain the angle $a\ c\ b$. Taking a top view of the base, as in Fig. 4, it is clear that the angle $b\ a\ d$ is equal to 45° and $a\ b = a\ d \cos 45$.

A table of cosines shows that

$$\cos 45^\circ = .7071,$$

therefore in all cases of a square center, of whatever cone angle,

$$a\ b = a\ d \times .7071 \qquad (1)$$

Let Fig. 5 be a perpendicular section of cone and square center on $A\ B$ of Fig. 3, $c\ d$ being the section of the cone surface and $c\ b$ of the square center surface. Let the half of the cone apex angle be α_1, and the half square center angle be α_2. Obviously

$$a\ d = a\ c \tan \alpha_1,$$

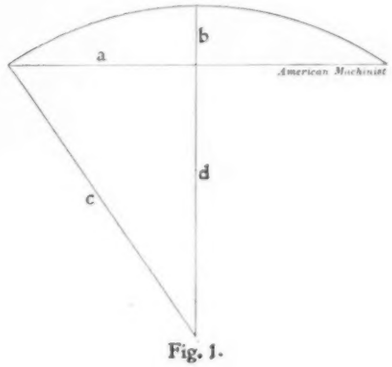

Fig. 1.

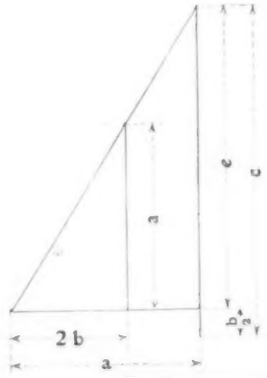

Fig. 2. American Machinist

Substituting this in (1) above gives

$$a\ b = .7071 \times a\ c \tan \alpha_1$$

whence

$$\frac{a\ b}{a\ c} = .7071 \times \tan \alpha_1,$$

but

$$\frac{a\ b}{a\ c} = \tan \alpha_2,$$

therefore

$$\tan \alpha_2 = .7071 \times \tan \alpha_1 \qquad (2)$$

from which the value of α_2 may be obtained for any value of α_1. If the cone apex angle = 90°, then $\alpha_1 = 45°$ and by (2)

$$\tan \alpha_2 = \tan 45^\circ \times .7071.$$

A table of tangents shows that

$$\tan 45^\circ = 1, \text{ hence}$$
$$\tan \alpha_2 = .7071,$$

which a table of tangents shows to be the tangent of 35° 16′—the value of α_2. If the cone apex angle be 60° then $\alpha_1 = 30°$ and

$$\tan \alpha_2 = \tan 30^\circ \times .7071.$$

A table of tangents shows that

$$\tan 30^\circ = .5773, \text{ hence}$$
$$\tan \alpha_2 = .5773 \times .7071$$
$$= .4082,$$

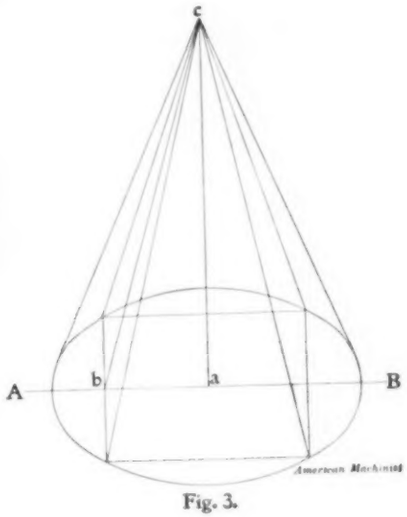

Fig. 3.

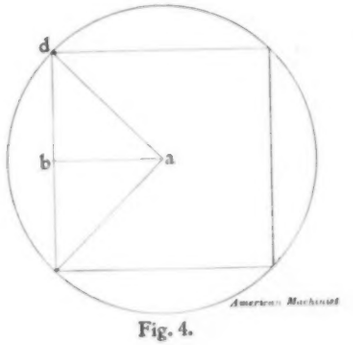

Fig. 4.

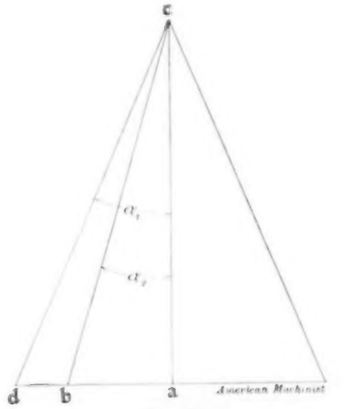

Fig. 5.

which a table of tangents shows to be the tangent of 22° 12′, the value of α_2 for a cone angle of 60°.

(101) H. L. M., Cropsey, Ill., asks for rules for proportioning steam-heating pipes to the buildings to be heated. A.—See reply to question No. 80 of this department, published in the issue for July 21 last, which covers your inquiry and many more. Your desired temperature of

80 degrees is higher than the standard by 10 degrees, but a slight addition to the heating surface would provide for it. Your pressure of 3 pounds would come under the head of low-pressure heating, for which the rules are intended.

(102) H. H., Syracuse, N. Y., asks how to calculate the length of a helix of 1 inch diameter and 3 inches pitch. A.—Conceive one turn of the helix to be rolled out flat. It will then be the hypothenuse of a right angle triangle of which the circumference is the base and the pitch is the hight. From the property of right angle triangles

$$\text{hypothenuse}^2 = \text{base}^2 + \text{hight}^2$$

or,

$$\text{hypothenuse}^2 = 3.1416^2 + 3^2$$
$$= 9.8696 + 9$$
$$= 18.8696.$$

Extracting the square root gives

$$\text{hypothenuse} = 4.344.$$

(103) G. S. C., Philadelphia, Pa., writes: I would like to know if there is a glue of some kind which will fasten gutta percha and brass together. A.—The following mixture will be found serviceable for such purpose: Powdered shellac is softened in ten times its weight of strong water of ammonia, giving a transparent mass, which becomes fluid after keeping for a short time without the use of hot water. In three or four weeks the mixture is perfectly liquid, and when applied will soften the gutta percha. When the ammonia evaporates the gutta percha hardens again.

(104) C. E. S., Cleveland, Ohio, writes: 1. The inclosed sketch represents a core box plane working in a half round box. Will you please demonstrate why it is that when the two sides of the plane bear at the points *a* and *b* the vertex of the right angle will describe the half circle. A.—The sketch referred to was not inclosed, and it is not necessary, as the plane referred to is now in common use in pattern shops. For a demonstration of the principle involved any standard treatise upon geometry may be consulted, the general statement of it being that "Any inscribed angle is measured by half the arc included between its sides." An inscribed right angle, or a right angle the apex of which touches the circumference, must with its sides cut the circumference at two points, which are the extremities of an arc of 180 degrees, and if a line is drawn from one of these points to the other the line will be a diameter of the circle. So in the use of the plane, if the sides of the right angle cut the two points or bear upon the two points, the cutting point at the apex of the right angle must coincide with the circumference, whether the two sides of the angle from its apex to the points at which they bear are at the time of the same length or not. 2. A gear wheel about 6 feet in diameter, six arms, uniform metal throughout and cast in steel, came out ½ inch out of round; what was the cause? A.—We are unable to say what was the cause. There are several conditions occurring in the processes of molding, pouring and cooling which might produce or contribute toward the production of the effect deplored. We do not know whether the wheel was molded from a whole pattern or otherwise. If made from a complete pattern it may not have been round to begin with, or it may have been sprung somewhat out of round in ramming. In pouring the wheel the metal may not have filled all portions of the mold at the same temperature, in consequence of an inequitable distribution of the gates. The wheel may not have been uncovered properly and one part may have cooled before another. The mold may have offered more resistance to the shrinkage of the rim and arms in one direction than in another. 3. What is the best book published on loam molding and on pattern making for loam molding? A.—We cannot say what is the best book published on this subject. "American Foundry Practice," by Thomas D. West, treats of loam molding, as does also "The Iron Founder," by Simpson Bolland, the latter book having more to say than the other about the pattern requirements for loam molding. Both books are by practical molders.

(105) F. P. H., Pittsburg, Pa., sends a sketch of locomotive slide valve, balanced on Richardson plan, and asks information about the forces holding the valve to its seat and those tending to lift it. A.—The actual aggregate pressure on the back of a plain slide valve is very uncertain, and its calculation is a subject of great difficulty. The most definite knowledge on the subject is contained in a paper read by Professor Robinson some years ago before the A. S. M. E. This paper described experiments in which a circular plate with a cavity in its lower side to represent the exhaust cavity of a slide valve was put under steam pressure in a box. A hole was cut through the bottom plate of the box which represented the valve seat to establish atmospheric pressure in the exhaust cavity, and through this hole forces were applied to lift the valve, these forces being measured and compared with the steam pressure in order to establish an area on which the full steam pressure might be supposed to act in order to produce a load equal to that actually shown to exist by the force necessary to lift the valve. Professor Robinson established the fact that this equivalent area was less than the full area of the valve but more than that of the exhaust cavity, and he accounted for the results by supposing a film of steam to constantly creep through the joint, the pressure of this film being equal to that in the chest at the entering edge and equal to the atmosphere at the leaving edge. We believe, however, that no exact law was established for the rate of fall of the pressure of this film or for the size of the equivalent area. You will see that the case of an actual slide valve is still more complicated than that of Professor Robinson's apparatus. In the first place the ports have no pressure in them during the exhaust and a varying pressure during expansion and compression, and in the second place the width of the joint through which the film acts constantly varies with the position of the valve. With the port entirely uncovered to exhaust, this width is equal to one face of the valve, but with the port only partly uncovered the width is lessened by the amount which the valve face overhangs the port, and moreover the two edges of the valve are never under the same conditions at the same time. Now, for perfect balancing the relief cavity, inclosed by the balancing strips, must be equal to the equivalent area described, but since the equivalent area constantly varies exact balancing is impossible, and the area of the relief cavity can only be made such as to take off only so much pressure as will not endanger the lifting of the valve. This is in all cases, we believe, determined by experiment, the area to be balanced being found to be from 55 to 60 per cent. of the total valve face area. If you desire to pursue the subject further we advise you to read Professor Robinson's paper, which is very instructive. There are no doubt many accessible files of the transactions of the A. S. M. E. in your city.

Personal.

Our contributor James F. Hobart has opened an office in the "Times" Building, this city, as mechanical engineer.

Mr. E. Sherman Gould, M. Am. Soc. C. E., has gone to Havana. His address is "Hotel Inglaterra, Havana, Cuba."

Our contributor, Mr. Thomas Wathey, recently with the Walker Company, of Cleveland, Ohio, has accepted a position as superintendent of the Hay Foundry & Machine Works, of Newark, N. J.

James C. Gourley has resigned the position which he has held for the past seven years as foreman of G. P. Clark's machine shop, Windsor Locks, Conn., to take effect November 1. He has been employed there eighteen years.

Mr. R. P. Howard, who for several years has been connected with the special machinery department of the Deering Harvester Company, of Chicago, has accepted a position as assistant superintendent of the Fuller & Johnson Manufacturing Company, of Madison, Wis.

Mr. L. C. Sharp, of Omaha, Neb., has sold his interest in the Omaha Electrical Works, founded by him in 1894, and has started a new shop under the title of the L. C. Sharp Machine Works, in the same city. Mr. Sharp considers that he has one of the best equipped small shops in the West.

Mr. K. A. Juthe, formerly superintendent of the Stanley Cycle Manufacturing Company, of New York city, and till recently with the Driggs-Seabury Gun & Ammunition Company, of Derby, Conn., has accepted a position as master mechanic of the Canadian General Electric Company, of Peterboro, Ont.

Prof. William S. Aldrich, having been honorably discharged from his late position in the United States Navy as past assistant engineer, resumes his work as head of the Department of Mechanical Engineering of West Virginia University. Professor Aldrich's work during the late unpleasantness was in connection with the fitting out and subsequent use of the repair ship Vulcan.

Mr. C. C. Newton, of the Newton Machine Tool Works, of Philadelphia, has just returned from a trip abroad, made on the invitation of John Brown, of Sheffield, England, and of Schneider & Co., of Creusot, France. With the former he placed an order for a special double radial drilling machine for armor plate, and with the latter a cold saw cutting off machine for the same class of work.

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Obituary.

Timothy McHugh, proprietor of a foundry in Chicago, and one of the oldest foundrymen in the city, died there October 16. He was born in Lincolnshire,

England, came to the United States while young, and learned his trade in Cincinnati.

E. C. Palmer, general manager of the Standard Tool Company, died at Stockbridge, Mass., October 13.

George Wilson Phillips, one of the first and principal inventors of match making machinery in this country, died at his home in Springfield, Mass., October 13, seventy-nine years old.

Samuel Lewis died in Pittsburg, Pa., October 10, seventy-four years old. He founded and operated the Lewis Malleable Iron Works, and had been for fifty years an active and prominent business man.

Louis De Blois Bartlett, formerly president of the Putnam Machine Company, Fitchburg, Mass., died at Marblehead, Mass., October 19, seventy-three years old. He was born in Marblehead and served his time with Otis Tufts in Boston, went to Fitchburg in 1859 and lived there the rest of his life. He became connected with the Putnam Company, and was successively director, treasurer and president, retiring from business in 1885.

Horace Wiley Soper died in Chicago October 11, fifty-six years old. He was born at Verona, N. Y., and was at first in the lumber trade. He engaged in the foundry business in Bloomington, Ill., residing there twelve years, when he went to Chicago to open an office for the concern there. About a year ago the name of the firm was changed from the Soper Foundry to the American Foundry & Furnace Company, with Mr. Soper still at its head.

Philip Inch, a chief engineer of the United States Navy, who was retired in August of this year, died at Saratoga, October 18, sixty-two years old. At his retirement he was senior officer of the engineer corps, having served forty-one years. He was born in the District of Columbia, and was appointed third assistant engineer in 1857, and promoted to second engineer in 1860. He was present when the first gun was fired at Fort Sumter. He became chief engineer in 1863.

John H. Dialogue, the well-known shipbuilder of Camden, N. J., died October 23, seventy years old. He was born in Philadelphia, and graduated from the high school in that city in 1846, after that learning the machinist trade with his uncle. He was a self-educated draftsman, and began business for himself in Camden in 1850, when but twenty-two years old, his first work being the repairing of locomotives for the Camden & Amboy Railroad and river steamboats, and later he built Corliss engines under the license of the inventor. In 1870 the works became the River Iron Works, with Dialogue & Wood proprietors, and in 1871 their first iron steamer the Colfax was built. Subsequently this firm built a great number of steamships, mostly for the coasting trade, and several also for the Government.

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At the old Tafford wharf of the Manchester ship canal a grain elevator has just been completed of the type and construction familiar to all who live near American grain shipping ports. This type of elevator is new in England, and was erected by J. S. Metcalf & Co., of Chicago. Practically all of the material of the structure as well as the machinery and appliances for handling the grain were supplied from this country. The elevator is the subject of an extended notice in "The Engineer" for October 7.

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An enterprising technical contemporary is reporting accidents in the following fashion:

"A 16-foot fly-wheel burst at P. L. Kimberley's rolling mill, Sharon, Pa., August 29, tearing away the feed pipe, thus causing the engine to stop. The bursting was probably due to the high rate of speed."

The feed pipe should have been better protected, so that the engine could have kept going. The suggestion that the high rate of speed had to do with the bursting of the wheel is novel.

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Technical Publications.

A HANDBOOK OF ENGINEERING LABORATORY PRACTICE. By R. H. Smart. 290 5 x 7¼ inch pages, with 62 illustrations. Wiley & Sons. Price, $2.50.

This is essentially a students' manual, intended for use in connection with routine experiments conducted for the purpose of instruction in laboratory work, but it will serve an excellent purpose in the hands of many practicing engineers when called upon to undertake experimental work with which they may have had little experience. In connection with student work it should save a large amount of tedious repetition of oral instruction covering the methods and objects of the tests described and the instruments employed.

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We have received Part XIII. of Meyer's "Easy Lessons in Mechanical Drawing and Machine Design," in which the intersection of surfaces is taken up. Following the author's general plan, a small instalment of the "theory" of the subject is immediately followed by applications of the principles taught to the laying out of the sheets for a locomotive smokestack hood and of steam boiler sheets. Following this the strength of beams is taken up, and graphical methods of determining the bending moments under various distributions of the load are explained.

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We have received from Mr. W. F. Durfee a copy of a pamphlet published by the Franklin Institute, of Philadelphia, and containing a valuable discussion before the Institute of the various means of preventing smoke from bituminous coal. The discussion was participated in by several leading engineers and contains a résumé of the subject. Appended to the pamphlet is a collection of smoke prevention ordinances as passed by various cities.

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Some time ago Mr. Geo. H. Reynolds, director and secretary of the Technical Instruction Committee, of Manchester, England, visited this country for the purpose of investigating matters of technical education in America. We have now before us his report to the committee named above, which shows that during his stay of about two months in this country he made a very thorough investigation of technical and trade schools here, and that he has been able to get at and state clearly the salient features of each of them. Mr. Reynolds also takes up the subject of apprenticeship here, and touches some upon our modern tall business buildings as well. The report ought to be of great interest to those concerned in technical education in England, and who have no opportunity to visit America.

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Sixth Annual Meeting of the Society of Naval Architects and Marine Engineers.

The following is the list of titles of papers to be read and topics for discussion at the approaching meeting of the above named society:

THURSDAY, NOVEMBER 10, 1898.

1. Torpedo Boat Destroyers for Sea Service, with Special Reference to the Conditions that Prevail on the Pacific Coast, by G. W. Dickie, member.
2. The Standard Navy Boats, by Arthur B. Cassidy, member.
3. Bilge Keels and Rolling Experiments U. S. S. Oregon, by Assistant Naval Constructor Lawrence Spear, U. S. N., member.
4. Steam Economy Test of a Unique Form of Feed Pump, by F. M. Wheeler, member.
5. Portable Pneumatic Riveters in Shipbuilding, by W. I. Babcock, member

Topical discussion of the following questions:

1st. The utility of torpedo boats, and has the sub-marine boat a place?

2d. In what respects have the recent naval engagements affected opinion as to

the value and best distribution of armor for war ships?

FRIDAY, NOVEMBER 11.

6. The Steam Yacht as a Naval Auxiliary, by William P. Stephens, Esq., associate.
7. Designs of the New Vessels for the U. S. Navy, by Chief Constructor Philip Hichborn, U. S. N., vice-president.
8. Methods of Securing Water Tight Work, by Assistant Naval Constructor H. G. Smith, U. S. N., associate.
9. Tests of the Strength of a Longitudinal Bulkhead Separating Two Engine Rooms, by Naval Constructor J. J. Woodward, U. S. N., member.
10. An Electrically Operated 150 Ton Revolving Derrick, by Walter A. Post, Esq., associate.
11. Stability of a Battleship under Damaged Conditions, by Prof. Cecil H. Peabody, member.

Topical discussions of the following questions:

1st. Under the circumstances of the blockade at Santiago, which was the more economical method of maintaining the boilers in readiness for immediate action—banking the fires or keeping them spread out very thin?

2d. Can you give any data as to the cost in coal of maintaining the engines and boilers in readiness for immediate service?

3d. What, if any, difficulty was there in maintaining the supply of fresh water for the boilers; and if there was any difficulty, to what do you attribute it?

4th. As a result of experience on the blockade, what particular points about the machinery were most likely to give trouble, and what could be done to prevent a recurrence of such trouble?

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Foreign News Notes.

In Bulgaria, where mills, tanneries, breweries, distilleries and other industries are being established, there is a considerable demand for machinery. Germany and Austria have almost the control of this field, although in sewing machines the Singer Sewing Machine Company has agents constantly on hand and has a monopoly of the trade. There is a large demand for pumping machinery, especially in hand-pumps for lifting water from 30 to 35 yards. The Bulgarian market for machinery is a growing one, and is capable of considerable expansion. The peasantry are being carefully instructed in the use of machinery preparatory to its introduction for industrial and agricultural purposes.

The duty on mining machinery and on ships built outside of Russia has been remitted by that country for a period of ten years from July last. Considerable benefit was expected to be derived by our manufacturers from the fact that the duty was also to be remitted on agricultural machinery in September, but so many restrictions have been introduced that the benefits are materially lessened. In the first place, machinery is only to be admitted free of duty when no similar machinery is manufactured in Russia. Then again the size requirements are, in many instances, unsatisfactory. American manufacturers have a monopoly in the district of Odessa in the matter of binders, reapers and mowers, and this success is attributed to the malleable steel used in the construction of this class of machinery. In portable engines and threshers the market is controlled by Germany. There is a market in Theodosia for plows, seed drills, manual delivery reapers, horse-power threshing machines, especially those fitted with straw shakers, riddle, corn screen and automatic feeder, all of which are used by the German colonists. A. F. T.

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Commercial Review.

NEW YORK, SATURDAY EVENING Oct. 22, 1898.

STEAM POWER PLANTS.

There are many evidences of a better tone in the engine and boiler markets. Even if local trade is not what it ought to be, the cases in which out-of-town works having branch offices in New York are very busy are so numerous as to create a favorable impression of these lines of industry. If not in every case a cause for hilarity, business seems on the whole to be very comfortable.

As usual the sales of engines in this disrict have largely been for lighting purposes. Street railway work still is a source of good inquiry. Quite a number of orders from factories in various localities have come to companies here represented, and at the office of a leading concern, whose reputation is connected chiefly with large engines, the inquiry for smaller ones for manufacturing purposes is now pronounced a feature of trade. Many sellers do not, however, notice an improvement in this line of work.

A notably good share of the orders that have appeared in this market at recent date have been secured by the New York office of the Harrisburg Foundry & Machine Company. For the new building being erected by the Trinity Corporation on Spring street, next to the Garvin Machine Company, 600 horse-power of their "Standard" engines have been ordered, in three units. For the new building of Phelps, Dodge & Co., on Cliff street, four "Ideal" engines have been purchased; for the Victoria Hotel, Thirty-fourth street, two 150 horse-power direct-connected "Ideal," and for the Pennsylvania Club, Long Branch, N. J., a new power plant. Among the other contracts may be mentioned sales of engines for installation in two Connecticut factories—those where the Eagle locks and Goodyear rubber gloves are made. Engines for lighting purposes have been ordered for erection in the towns of Halstead and Pecksville, Pa., the latter amounting to 300 horse-power.

The Phœnix Iron Works, Meadville, Pa., are reported as having a gratifying volume of orders on hand, especially in the line of high pressure boilers, upon which they are extremely busy. In this vicinity they are now installing 500 horse-power of their tandem compound engines (Dick & Church) in the plant of the Standard Oil Company, Bayonne, N. J. Among work now on hand is 1,000 horse-power of boilers for Pittsburg.

Messrs. Burhorn & Granger, 136 Liberty street, New York, are at present engaged in installing a complete steam plant in the storehouse at the Brooklyn Navy Yard, including three "Marine" type self-contained boilers of 80 horse-power each, together with breeching and smokestack; also Philadelphia Corliss engine, with pump, feed water heater and pipe connections. They also have a contract for three 100 horse-power boilers, together with the self-supporting stacks, castings and fittings, to be erected at the League Island Navy Yard, Philadelphia, Pa. They also report several recent sales of the "Star" water tube boiler, including some for buildings in New York city.

The Edward P. Allis Company is said to have received an order from the Sheffield Electric Tramways Company, England, for three engines.

The Bass Foundry & Machine Works will equip the new silk mill at Allentown, Pa., belonging to C. A. Zienderstein, with a power plant consisting of two boilers, 150 horse-power engine, heaters, pump, flue, etc.

The Chambersburg Engineering Company is very busy, particularly on steam hammers. In the engine line it has sold, within the last two weeks, two 300 horse-power automatic engines for running large blowers; also a 250 horse-power engine for the Providence Silk Mills, Scranton, Pa. The Fitchburg Steam Engine Company is also experiencing an increasingly active trade, and its work now on hand tends to show healthy conditions in various lines of industry. It is building, in particular, a 750 horse-power compound engine for a cement works in the Lehigh Valley (Pa.) region, and two 18x42-inch engines, one for Burke Brothers, Philadelphia, morocco manufacturers, and the other for Keasbey & Mattison, Ambler, Pa. A. F. Buchanan & Sons, oil cloth manufacturers, Buchanan, N. Y., have ordered an engine of this make and a General Electric 100 kilowatt two-phase generator for an electric power-distribution system in their establishment. Fitchburg engines are also being built for the Charleston and New York navy yards. Houston, Stanwood & Gamble are loaded up with Western orders. Mr. Edwin H. Ludeman, 39

Cortlandt street, New York, represents the engine builders mentioned in this paragraph.

The Buckeye Engine Company has within a few weeks past made a further increase in its hours of work. It is running with double shift.

The Ames Iron Works have had good sales this season in engines to go to the districts of Singapore and Yokohama, chiefly for lighting purposes.

Three engines, aggregating $9,000, were purchased at local offices this week for electric light plants in Mexico.

A rolling mill company in Rhode Island is in the market for an engine, or engines, of 1,000 or 1,500 horse-power. It is thought quite probable that the boilers and other portions of the plant are yet to be contracted for.

The Boston Electric Light Company has asked permission of the building commissioner to erect twelve boilers, seven engines and 100 dynamos in the building on East First street, corner of L, it is said. The number of dynamos may be a mis-report.

A certain engine company in Massachusetts has notified its New York agent to take no more business at old prices.

GOOD SALES OF BOILERS.

The following important contracts are reported from the West: Wickes Brothers, East Saginaw, Mich., recently sold 2,000 horse-power of their vertical water tube boilers for the Armour grain elevator; also 3,750 horse-power to Armour & Co. for the new central steam plant at the stock yards.

We learn that the Stirling Boiler Company, Chicago, although the capacity of its works has been doubled within a year, has orders enough on hand to keep it busy for four months and is working the large tools in its shops at night. Since the first of this month it has received orders amounting to 5,000 horse-power, and perhaps more by our actual time of writing.

The Abendroth & Root Manufacturing Company, N. Y., whose activity for some months past has been chiefly in the pipe line, and is still, has just gone over to double shift. The boiler part of the business is now showing a recovery. The Riverside Fiber Company, Appleton, Wis., has purchased 500 horse-power of these boilers, in two units: the Standard Heat, Light & Power Company, Unadilla, N. Y., 127 horse-power.

MACHINE TOOLS.

The auction sale for Hill, Clarke & Co. of the machinery of the old Ames Manufacturing Company, Chicopee, Mass., which began October 19, was then somewhat affected by the weather, but passed off well the following day. In reply to inquiries addressed by us to Messrs. Hill, Clarke & Co., we are informed that the new machinery sold October 20 brought very fair prices and the second-hand machines in good order brought very good prices, but the old tools that had seen many years' service went very low. Some of the large tools that were difficult to move were also sold at small figures. A 96-inch by 33-foot Wilmarth pit lathe, 16-foot swing over the pit (No. 321, on page 6 of the circular), which cost over $5,000, and is still in excellent running order, sold at $175. A 72x72-inch by 20-foot planer, two heads (No. 325, on page 6), valued at $3,000 or $4,000, brought only $500.

The German market for American machinery is considered by local authorities at the present time to be decidedly more active than the British. It is said that the German-Austrian Mannesmann Tube Company's factory, which is being constructed at Roth, near Düsseldorf, is still in need of some large tools. For shipment to Rotterdam, Holland, an export firm was asking quotations this week on some machine tools and two hydraulic presses.

The lathes included in the equipment of the new Franco-American Motor Carriage & Bicycle Company have been contracted for with Hill, Clarke & Co., who will furnish over ninety in all. The larger ones will be Mark Flather and the smaller ones Fitchburg. It is also reported that the screw machines, twenty-five or thirty in number, will be of Bardons & Oliver make, and will be sold through Hill, Clarke & Co. It is not entirely certain, however, that the contract for the screw machines has yet been closed.

The Fifield Tool Company is now shipping a 37-inch by 25-foot lathe of special design for the United States Navy Department.

The following companies have recently been formed in Russia, and most of them will, it is said, require improved tools and machinery, of which the greater part is expected to be bought in this market: The Riga Cast Steel Company, with a capital of $375,000; the Gerlach & Pulst Machine Company, Warsaw, capital $725,000; the Falga Hardware Manufacturing Company, capital $200,000, and the Metalfabrik Company, of Kound, capital $750,000.

ELECTRIC RAILWAYS IN "THE COLONIES."

A company has been formed in Honolulu, it is said, to build an electric railway. Mr. C. G. Bellentyne, general manager, is expected to arrive in New York about December 15 to make purchases. A dispatch from Santiago de Cuba says that General Wood has granted a franchise for an electric road from that city to the cemetery and to El Caney. It is hardly expected to pay its expenses for the first three years.

NEW GOVERNMENT CONTRACTS.

The United States Navy Department is in the market for quite a variety of machinery. The Bureau of Yards and Docks requires a locomotive jib crane, 40 tons gross capacity, estimated cost $40,000, for the Port Royal, S. C., naval station; bids to be opened November 26. An electric light and power plant is to be installed for it at the naval station, Puget Sound, Bremerton, Wash.; bids to be opened October 29. The above bureau will also, in the near future, require an electric plant, with buildings and machinery, for the New York Navy Yard.

The Bureau of Supplies and Accounts needs, for the Norfolk, Va., Navy Yard, two 36-inch by 24-foot bed lathes, a 65-inch horizontal boring mill and 10,000 condenser tubes; bids to be opened October 29. For the New York Navy Yard it will purchase about 15,000 boiler tubes of lap weld charcoal iron, 16,250 of lap weld steel and 16,150 of solid drawn steel; bids to be opened October 29.

W. H. Benyaurd, lieutenant-colonel of engineers, St. Augustine, Fla., will receive proposals to furnish at Tampa, or on Mullet and Egmont Keys, steel beams, anchor bolts and ammunition trolley systems, hoists and cranes; bids to be opened November 21.

Bids to supply machinery and machine tools for the Bremerton, Wash., naval station were opened October 18. We have not yet heard that the awards have been made, but the lowest bids on some of the more important items were as follows: Manning, Maxwell & Moore, 30-inch by 30-foot traverse wood planing machine, $715; screw machine, $717. Henry L. Tatum, San Francisco, 10-inch four sided molding machine, $830.

(Continued on page 40.)

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Business Specials.

Gear wheels, gear cutting, Grant; see page 18.

Forming Lathes. Mer. Mach. Tool Co. Meriden, Conn.

Send for my water tube boiler catalog. E. P. Watson, Elizabeth, N. J.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

A manufacturing concern having large shops with modern tools, foundry, pattern shop, etc., is desirous of adding to its present line, and wishes to negotiate with parties wanting mach'y. built. Box 36, AM. MA.

For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Wanted—A pos. by an exp'd locomotive draftsman and machinist; 8 years' experience. Box 69, AM. MACH.

A competent draftsman, experienced in designing special and intricate machinery, desires steady position in New York or Brooklyn. Box 49, AM. MACH.

(*Continued from page 39.*)

Fitchburg Machine Works, engine and screw cutting lathe, 36 inches swing over bed, 15 feet between centers, $1,614. Thomas Rickard, San Francisco, 18-inch by 5-foot screw, cutting engine lathe, $470; 12-inch by 5-foot screw cutting engine lathe, $310; 20-inch shaper, $289. J. W. Cregar, 36-inch planing machine, $1,715. Pacific Tool & Supply Company, San Francisco, plain milling machine, $1,075. General Electric Company, direct-connected generating set, 75 kilowatts, $6,200.96.

The contract to construct coal sheds, coal handling machinery, etc., at the New London naval station was awarded to J. W. Hoffman & Co., of Philadelphia, at $137,500.

MISCELLANEOUS.

In the first half of 1897 $2,211,477 worth of machines was imported into Switzerland and $3,103,293 worth was exported.

A certain pipe manufacturing company represented in New York has orders enough on hand to keep it busy until the middle of next February.

The water works trustees, Marietta, Ohio, ask bids upon a 3,000,000-gallon pumping engine, to be opened October 31.

CHICAGO MACHINERY MARKET.

About the only way conflicting reports concerning the present engine and boiler trade in the West can be reconciled is to repeat a former observation that the large trade is relatively much more active than the smaller trade. Plants which make a specialty of the larger work are simply overwhelmed with work and are turning away as much or more than they are accepting. While this large work is going mainly into street railway plants, other lines of industry are rising to that level. Steel mills have been very good buyers of blowing and other high grade power during the past month or two, and the improvement thus begun is extending to all mills of that kind. The demand for steel product has been so keen for several months past that the makers are driven to make every possible improvement to increase their output, and enlargement of capacity has been the rule. Quite a number of high power engines have been placed in the Pittsburg district and some have been sold in the South also.

General manufacturing plants are also more evident in the market. Quite a number of manufacturers were in the city last week, and while here paid their respects to the machinery trade. A summary of their opinions is that business will be very good in the spring. Saw-

(*Continued on page 41.*)

Situations Wanted—Continued.

Blacksmith—Am a 1st class tool dresser. B. 66, AM MA.

Good, practical draft'n desires pos. Bx. 67, AM. MACH.

Position as mechanical sup't; good designer; exp. gen. steam engineering; good ref. Box 62, AM. MACH.

D'fts'n; 5 yrs.' exp; pumps, elect. tract., gen. mach.; first-class refs.; French; London, 1 yr. Bx. 51, AM. MACH.

Frenchman speaking German and English, experience as salesman in France in tool and machine tool business, wants position. Box 46, AM. MACHINIST.

Young machinist, good education and experience, drafting, desires position with machinery dealer in New York City. Good references. Box 54, AM. MACH.

Desire change, am American, 30, good mgr., thoroughly posted in shop prac.; like to assist busy sup't or take charge of and b'ld up small shop. Bx. 63, AM. MACH.

Draftsman and mechanical engineer, 20 years' varied experience; practical designer of high grade engines, tools, etc., desires situation. Box 23, AM. MACHINIST.

Draftsman, educated, 9 years' experience in machine tools, automatic and special machinery, jigs, etc.; position of responsibility only. Box 68, AM. MACHINIST.

By practical machinist and draftsman, by January 1, position as sup't of machine shop; exp. in power presses, punches and dies, perforating machines, eyelet and rivet machines, etc., etc. Box 58, AM. MACH.

Mechanical draftsman, technical graduate, wants position; 9 1-2 years' experience as draftsman; general machinery, steam engines, blast furnaces; best references; moderate terms. Box 61, AM. MACHINIST.

Mech. eng. with 12 yrs.' exp. as head dr'fts'n in some of leading estbs. in this country and Europe, desires an indep'dent pos.; specialties: quick figu'g, plan. new m've's on auto. mach.; best refs. Ad. Bx. 65, AM. MACH.

Wanted—Position by practical machinist and Eastern graduate mechanical engineer; can design and handle electrical machinery, and do mine and railroad surveying and plating; with mining company at home or abroad preferred; references of character and ability. Address Box 59, AMERICAN MACHINIST.

Help Wanted.

Wanted—First-class machinists. Box 70, AM. MACH.

Wanted—Up-to-date machinist as foreman on marine engine work; state age, experience and salary expected. Phœnix Iron Works, Port Huron, Mich.

Wanted—Sup't capable of handling 25 men and having $5,000 to invest can fix himself in an old, profitable concern building light mach'y. Ad. Box 57, AM. MACH.

Wanted—Assistant superintendent or machine shop foreman who is a practical cost cutter and a thorough hustler; no other need apply; state experience and references. Box 64, AMERICAN MACHINIST.

Ass't Manager Wanted—Small manuf'g concern; emp. 50 men; mech'c with knowledge of elect'y; live man needed; one who would take a moneyed interest pref'd; bus. estb. and successful. Box. 55, AM. MACH.

Wanted for large bicycle and automobile factory in Belgium, a first-class draftsman and tool-maker thoroughly familiar with bicycle work, to take position as assistant superintendent; also a first-class polishing and plating foreman; only first-class men need apply, stating experience and salary expected, with references. Address Box 52, AMERICAN MACHINIST.

Wanted—Competent man for foreman in a machine shop, one familiar with general machine work; good opportunity for the right man; state age, experience, salary desired and reference. Address Box 60, AMERICAN MACHINIST.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Philadelphia Book Co., Phila., Pa., catalog free.

Caliper catalog free. E. G. Smith, Columbia, Pa.

Bock, Dies & Die Making, $1. J. L. Lucas, Prov., R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Drawing and Technical office, 78 Avenue du Midi, Brussels, Belgium. Information of all kinds.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted—Machines for the manufacture in large quantities of shafting. Box 50, AMERICAN MACHINIST.

Wanted—A second-hand No. 1 Brown & Sharpe milling machine; must be in good condition and cheap. Address Box 71, AMERICAN MACHINIST.

Wanted—To negotiate for a location or existing plant for the manuf. of automatic engs., by a well estb. concern; state fullest partic's. Bx. 53, AM. MACH.

Wanted—Agencies for good special machinery, tools and engines by a firm with good central premises in the city of London, England. State terms in your reply to Box 999 at Messrs. Smith's Advertising Agency, 132 Fleet Street, London, England.

Institutions retiring from business having machine tools, brass or wood working machinery, will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach Co., 55-59 Woodbridge st., W., Detroit, Mich.

An established manufacturing company near New York City wishes to lease its foundry to a practical foundry man; will furnish four to five hundred dollars' worth of business per month from the start; fine opening for the right man; no agents recognized. Address Box 56, AMERICAN MACHINIST.

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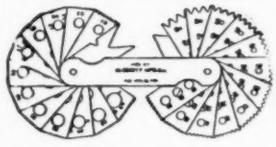

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5. Every Valve Tested before leaving the factory.
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Agents in London. SELIG, SONNENTHAL & CO., 85 Queen Victoria St.

We Make **Boring Machines, Milling Machines, Special Tools** BEAMAN & SMITH, PROVIDENCE, R. I.

(*Continued from page 40.*)

mill men in the Northwest are figuring on buying considerable power this winter. Some sellers of engines say that trade is only fair; that the month of October has not opened so favorably as they anticipated, but the rule is that engine and boiler shops are busy, and chances are about even that they cannot make prompt delivery of product. Prices are stable at the recent low levels, save on the high grade engines, which are steadily strengthening in value.

Orders for shop saws keep ahead of the capacity of the Q & C Company to produce. The company has just sold one of their power saws, the largest size made, to the American Steel Foundry Company, of St. Louis, and the outlook is good for several more large orders near at hand. The company has just sold two new Q & C power rail sawing machines, No. 11, a specialty for cutting tool steel and other hard metals, and prospects are bright for large sales to railroads and to manufacturers. The foreign orders for sawing machines are very good, one which is in sight being for over fifty machines, all to be shipped abroad.

For this season of the year mining machinery is active. There is a ready sale only in districts where mining is not interrupted by winter snows. Among the orders recently placed by the Gates Iron Works are the following: A 200-ton concentration plant mill to the Big Hit M. & M. Company, Hill City, S. Dak.; a 60-ton cyanide plant mill to the Rose Gold M. & M. Company, Victor, Col.; a ten-stamp gold mill at Congress, Ariz., and a steam stamping mill for the Anglo-Mexican properties, Chihuahua, Mexico. The inquiry from Mexico is increasing.

The Edward P. Allis Company has just sold another large blowing engine in the Pittsburg district for delivery in nine months. For smaller engines, of about 200 horse-power, the company is not quoting deliveries under ninety days.

▲ ▲ ▲

Quotations.

NEW YORK, Monday, October 24.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 25 @ 11 50
No. 2 foundry, Northern	10 75 @ 11 00
No. 2 plain, Northern	10 50 @ 10 75
Gray forge, Northern	10 00 @ 10 25
No. 1 foundry, Southern	11 25 @ 11 50
No. 2 foundry, Southern	11 00 @ 11 25
No. 3 foundry, Southern	10 75 @ 11 00
No. 1 soft, Southern	11 25 @ 11 50
No. 2 soft, Southern	10 75 @ 11 00
Foundry forge, Southern	10 00 @ 10 25

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.30 @ 1.35c.; refined, 1.35 @ 1.50c.

Tool Steel—Base Sizes—Standard quality, 6 @ 7c., with lower prices on some brands; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.45 @ 1.50c.

Cold Rolled Steel Shafting—Base sizes, from store, 2.20 @ 2.25c., according to quantity.

Copper—Carload lots, Lake Superior ingot, 12½c.; electrolytic, 12¼ @ 12⅜c.; casting copper, 12 @ 12¼c., for ordinary brands.

Pig Lead—Carload lots, 3.62½ @ 3.70c., f. o. b. New York.

(*Quotations continued on page 42.*)

20 in. x 8 ft. Hendey=Norton Lathe.

• • •

ALL these Lathes have the Norton Screw Cutting feature. All the different threads and feeds in daily use obtained by moving the handle in gear box from one notch to the other. All sizes but the 32 in. fitted with our Automatic Stop Rod for carriage. By its use you can cut threads to and from shoulders and always have the carriage stop in the same place. All lathes have the reverse motion in head, operated by lever at side of apron. By this you reverse the carriage only, which is all that is necessary in cutting threads.

These attachments mean a great saving of time and labor.

THE HENDEY MACHINE CO.,

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J. W. CREGAR, . . Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:

SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.
ADOLPHE JANSSENS, ... Paris, France.

(*Quotations continued from page 41.*)

Pig Tin—For 5 and 10 ton lots, 18 @ 18⅛c. f. o. b.

Spelter—Carload lots, 5.12½ @ 5.15c., New York delivery for ordinary brands.

Antimony—In cask lots: Cookson's, 9½c.; Hallett's and French E. B., 8⅞ @ 9c.; Japanese, 8¾ @ 8⅞c.; United States, 8.70 @ 8.75c.

Lard Oil—Prime city, ice pressed, 44 @ 46c., in wholesale lots.

▲ ▲ ▲

Manufacturers.

The Ludowici Roofing Tile Company, Chicago, Ill., is building an addition to its plant.

The plant of the Little Falls (N. Y.) Paper Company is being enlarged and new machinery put in.

Thos. Potter, Sons & Co., Philadelphia, Pa., are to erect an addition to their plant at a cost of $20,000.

The American Manufacturing Company, St. Louis, Mo., will erect a one story addition to its factory.

Jerome H. Bishop will establish a rug factory at Sandwich, Mich., and will require the necessary machinery.

The H. W. Caldwell's Sons Company is about to construct a new building on Twenty-second street, Chicago, Ill.

The Dunbarton Flax Spinning Company, Greenwich, N. Y., contemplates enlarging its plant by adding some new machinery.

George W. Sharp, proprietor of the soap factory at Boothwyn, Pa., is preparing to put in an engine and boiler and other machinery.

The National Starch Works, Glen Cove, L. I., is putting up the foundation for another large building to adjoin its present buildings on the south.

The Sweetwater Woolen Mills, of Sweetwater, Tenn., have awarded a contract to Thomas & Turner, of Knoxville, Tenn., for the erection of additional buildings.

William Franzen & Son have taken out a building permit to erect a glass works on Chase street, Milwaukee, Wis., at a cost of $3,600. The old glass works at that site burned down a few weeks ago.

The two-story brick machine shop at C. G. Hussey & Co.'s copper and brass rolling mills, at Second avenue and Murphy streets, Pittsburg, Pa., was destroyed by fire recently. Loss, about $10,000.

William Campbell, the knit goods manufacturer, has begun the work of converting the old Roberts pulp mill, at Bennington Falls, Vt., into a yarn mill. It is said that the outlay will amount to about $40,000.

Building of the F. A. Millett machine shop, Livermore Falls, N. Y., will go on rapidly and a building erected to the idea of the owner will be the result, and the shop is expected to be running at an early date.

The work on the new Roycroft shop, E. Aurora, N. Y., is progressing rapidly. The foundation is nearly completed and the frame work will be commenced the latter part of the week. The new building is 27x60.

Work is progressing on the foundation for an eight story factory building that is to be erected for E. H. Van Ingen, of New York, on South Canal street, Chicago, Ill. The plans are for a general factory building covering 47x157 feet of ground. It is to cost $70,000.

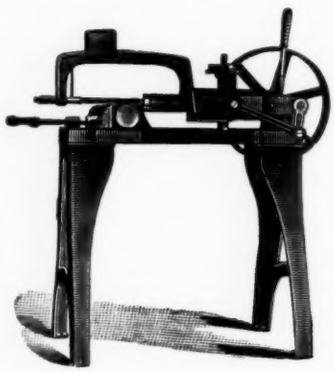
Wyandotte, Mich., will probably soon receive another substantial acquisition to her manufacturing enterprises. The Michigan Alkali Company, of which Capt. J. B. Ford is the central figure, has determined to build an annex to the upper factory on the north of Wyandotte, and much larger than the original building. The annex will be about 1,000 feet long will be built of brick and iron, and will cost about $800,000. It is also intended to erect a large building on the site of the lower factory in Wyandotte, for the manufacture of cement, which will be made from the residuum of soda ash.

"The best is as good as any."

The New

Automatic and Gravity Feed

Q & C Shop Saw



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Index to Advertisers.

	PAGE
Acme Machinery Co.	20
Adams Co.	55
Albro-Clem Elevator Co.	45
Almond, T. R.	52
American Gas Furnace Co.	2
American Tool & Machine Co.	6
American Tool Works Co.	17
American Turret Lathe Works Co.	4
Armstrong Bros. Tool Co.	50
Armstrong Mfg. Co.	4
Backus Water Motor Co.	45
Baird & Co., Henry Carey	45
Baird Machinery Co., U.	9
Baker Bros	9
Baldwin, Davidson & Wight	8
Ball Bearing Co.	20
Barnes & Co., W. F. & John	8
Bartlett, Edward E.	44
Bay State Iron Works	54
Beaman & Smith	44
Becker Mfg. Co., John	10
Bement, Miles & Co.	49
Berlin Iron Bridge Co.	55
Besly & Co., Chas. H.	56
Bethlehem Foundry & Machine Co.	46
Bethlehem Iron Co.	53
Bickford Drill & Tool Co.	14
Bignall & Keeler Mfg. Co.	45
Bilgram, Hugo	46
Billings, Spencer & Co.	4
Bliss Co., E. W.	52
Boston Gear Works	45
"Box 72"	15
"Box 73"	15
Bradford Belting Co.	4
Bradford Mill Co., The	46
Bristol Co.	56
Brown & Co., R. H.	48
Brown & Sharpe Mfg. Co.	56
Buckeye Engine Co.	53
Buffalo Forge Co.	56
Builders' Iron Foundry	8
Bullard Machine Tool Co.	51
Bullock Electric & Mfg. Co.	18
Burr Mfg. Co.	55
Burt Mfg. Co.	40
Carborundum Co., The	12
Card Mfg. Co., S. W.	15
Case Mfg. Co.	52
C & C Electric Co.	8
Chandler & Taylor Co.	54
Cincinnati Milling Machine Co.	1
Cleveland Machine Screw Co.	4
Cleveland Twist Drill Co.	56
Clough, R. M.	45
Coffin & Leighton	55
Cook Co., Asa S.	3
Crescent Steel Co.	12
Crosby Steam Gage & Valve Co.	55
Curtis & Co., Mfg. Co.	19
Curtis & Curtis	4
Cushman Chuck Co.	3
Dallett & Co., Thos. H.	41
Davis Machine Co., W. P.	20
Dayton Globe Iron Works Co.	54
Detrick & Harvey Machine Co.	55
Diamond Machine Co.	12
Dixon Crucible Co., Joseph	3 and 46
Doan & Co., J. B.	15
Draper Machine Tool Co.	5
Dwight Slate Machine Co.	55
Eames Co., G. T.	53
Errington, F. A.	3
Evans, Friction Cone Co.	3
"Factory"	15
Faneuil Watch Tool Co.	45
Farquhar Co., A. B.	45
Fay & Egan Co., J. A.	15
Fay & Scott	16
Fellows Gear Shaper Co.	12
Fifield Tool Co.	56
Fitts Mfg. & Supply Co., Frank E.	40
Flather & Co.	20
Foos Gas Engine Co.	54
Forbes & Co., W. D.	54
Fox Machine Co.	20
Fraser Machine Works	4
Frick Co.	54
Gang & Co., Wm. E.	3
Garvin Machine Co., The	18
General Electric Co., The	44
Geometric Drill Co.	3
Gisholt Machine Co.	47
Gleason Tool Co.	20
Goodyear, S. W.	4
Gould & Eberhardt	20
Grant Gear Works	20
Gray Co., G. A.	20
Haeseler & Co., C. H.	48
Hampden Corundum Wheel Co.	3
Hart Mfg. Co.	53
Hartford Steam Boiler Insp. & Ins. Co.	14
Henderer's Sons, A. L.	14
Hendey Machine Co.	39
Hobson, Seaman & Co.	48
Hoggson & Pettis Mfg. Co.	3
Horton & Son Co., E.	3
Hunt Co., C. W.	45
Hurlbut-Rogers Machine Co.	3
Hyatt Roller Bearing Co.	2
Ingersoll-Sergeant Drill Co.	8
International Correspondence Schools	43
Jenkins Brothers	40
Jessop & Sons, Wm.	46
Jones & Co., B. M.	12
Jones & Lamson Machine Co.	20
Kelley Machine Co., R. A.	4
Kempsmith Machine Tool Co.	12
Keuffel & Esser Co.	4
Keystone Drop Forge Co.	12
Keystone Electric Co.	17
Landis Tool Co.	10
Le Blond, R. K.	56
Le Count, Wm. G.	3
Lodge & Shipley Machine Tool Co.	10 and 15
Long & Alstatter Co.	52
Lucas & Gliem	20
Mackey Co., The	14
Main Belting Co.	55
Maris Brothers	48
Marshall & Huschart Machinery Co.	15
McCabe, J. J.	15
Mergenthaler & Co., Ott	7
Merrell Mfg. Co.	53
Mianus Electric Co.	54
Mietz & Weiss	54
Monarch Mfg. Co.	54
Montgomery & Co.	14
Morse Twist Drill & Machine Co.	19
Morse, Williams & Co.	55
Morton Mfg. Co.	3
New Doty Mfg. Co.	52
New Era Iron Works	54
New Haven Mfg. Co.	11
New Process Raw Hide Co.	53
New Process Twist Drill Co.	8
Newton Machine Tool Works, Inc.	12
Nicholson File Co.	12
Niles Tool Works Co.	44
Niles Tool Works Co., New York Branch	15
Norton Emery Wheel Co.	52
Oesterlein Machine Co., The	20
Oster Mfg. Co.	55
Pearson Machine Co.	56
Philadelphia Book Co.	8
Phosphor Bronze Smelting Co.	45
Pierce Engine Co.	54
Pond Machine Tool Co.	7
Pope Tube Co.	5
Powell Planer Co.	46
Pratt & Whitney Co.	50
Pratt Chuck Co.	3
Prentiss Tool & Supply Co.	42
Q & C Co.	41
Rand Drill Co.	54
Reed Co., F. E.	40
Reeves Pulley Co.	8
Rogers Boat, Gage & Drill Works, John	14
Rue Mfg. Co.	54
Safety Emery Wheel Co.	55
Saunders' Sons, D.	52
Sebastian Lathe Co.	40
Sellers & Co., Inc., Wm.	20
Seneca Falls Mfg. Co.	41
Shultz Belting Co.	20
Sibley & Ware	53
Skinner Chuck Co.	3
Slocomb & Co., J. T.	44
Smith & Mills	46
Snyder, J. E.	4
Spencer Auto. Machine Screw Co.	17
Springfield Gas Engine Co.	54
Springfield Machine Tool Co.	50
Standard Tool Co.	56
Starrett Co., L. S.	48
Steam Engine	15
Steel Ball Co.	45
Stevens Arms & Tool Co., J.	53
Stiles Press Co., E. S.	4
Stover Novelty Works	12
Stuart's Foundry & Machine Works, R. J.	56
Sturtevant Co., B. F.	18
Syracuse Twist Drill Co.	54
Tight, Joint Co.	55
Timolat, J. G.	3
Toledo Machine & Tool Co.	3
Toomey, Frank	15
Trump Bros.' Machine Tool Co.	3
Turner, Vaughn & Taylor Co.	44
T. & B. Tool Co.	20
U. S. Metallic Packing Co.	6
Walker, John	53
Walker, O. S.	56
Warner & Swasey	56
Watkins Co., F. M.	54
Watson-Stillman Co., The	14
Webb Hinge Belt Hook Co.	4
Weber Gas & Gasoline Engine Co.	54
Webster Mfg. Co.	54
Webster & Perks Tool Co.	6
Wells Bros. & Co.	14
Westinghouse Electric & Mfg. Co.	16
Whitcomb Mfg. Co.	44
Whitney, Baxter D.	15
Whiton Machine Co., D. E.	6
Wiley & Sons, John	40
Wiley & Russell Mfg. Co.	11
Williams & Co., J. H.	4
Winkley, F. D.	4
Woodward & Rogers	4
Worcester Machine Screw Co.	8
Wyke & Co., J.	45
Wyman & Gordon	56
Young Mfg. Co., W. C.	4

▲ ▲ ▲

Contents.

	PAGE.
A Notable German Tool Shop	21
The Rapid Decrease of British Exports to the United States	30
Patents and Exports	30
The Use of the Tri-Axial Diagram for Graphical Illustration	31
Lathe Attachment for Turning Cast Wrist Pins. By C. P. Benns.	31
Letters from Practical Men: Indicator Practice. By M. E. Different Competitive Opportunities. By Tesumseh Swift. A Well-Tried Rod Packing. By Fred E. Rogers. A Chucking Gage. By Fred E. Rogers. A Little Correction. By W. O. Johnson	33-35
Photographs and Photographs	36
The Modest Little Shops	36
Death of Horace B. Miller	37
Obituary	37
Personal	37
Commercial Review	37

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American Machinist,

256 Broadway, New York.

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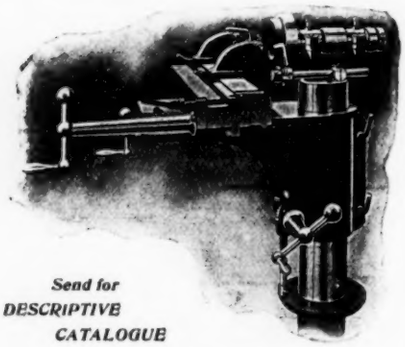

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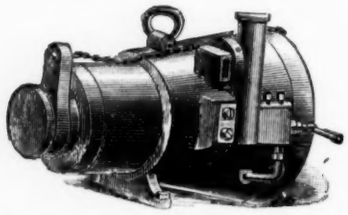

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It's built for inserting and removing crank pins, pushing bridges and similar heavy work. Will push from 60 to 150 tons.

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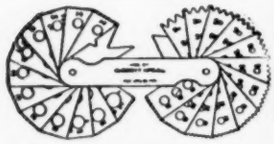

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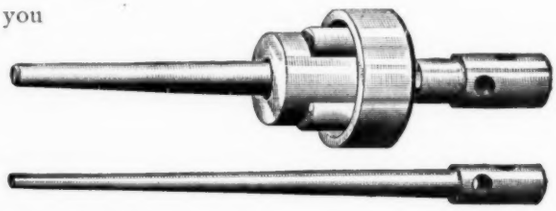

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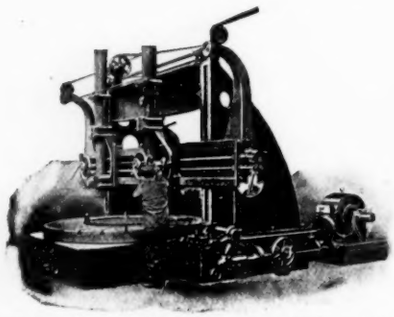

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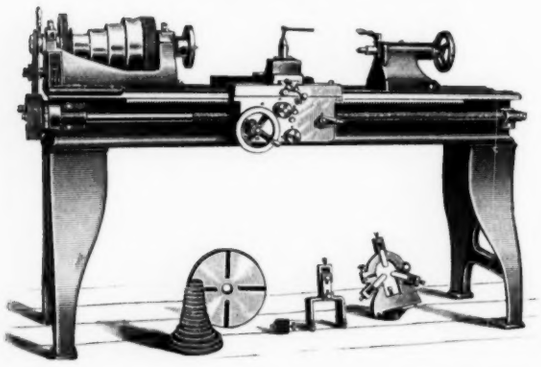
are good Engine Lathes in every possible way.



There's an interesting price on our 28-inch and 32-inch Engine Lathes, and it might be to your advantage to investigate, at least.

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A machinery ad in a medium not thoroughly read by mechanics is like advertising bathing suits in Lapland.

Make your ad talk about the thing you are advertising in a terse, simple, straightforward way, just as a good salesman would talk to a customer.

When your ad is ready for the printers, go over it once more and see how many words you can leave out.

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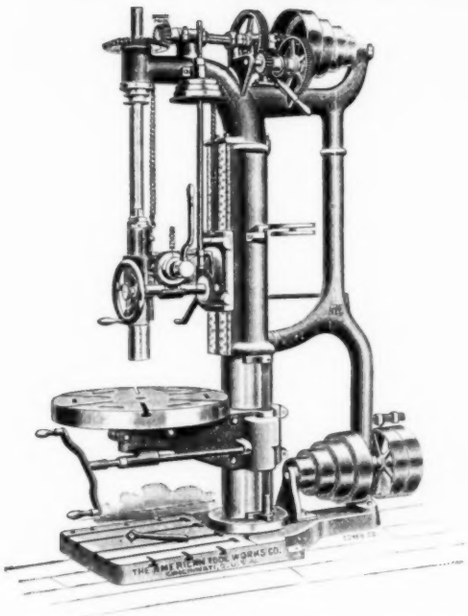
Successors to THE DAVIS & EGAN MACHINE TOOL CO.



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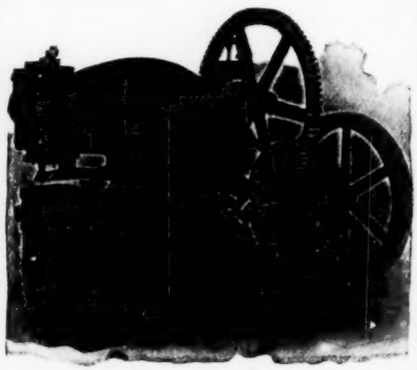

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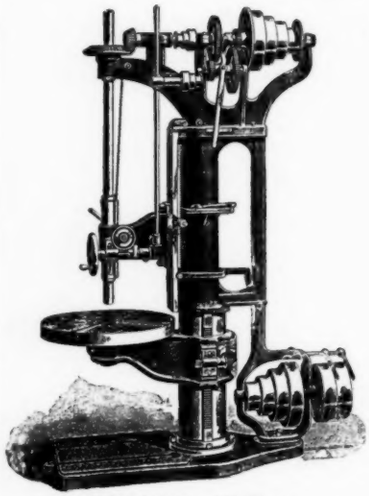

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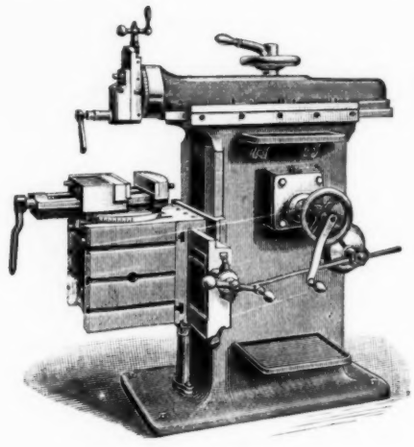

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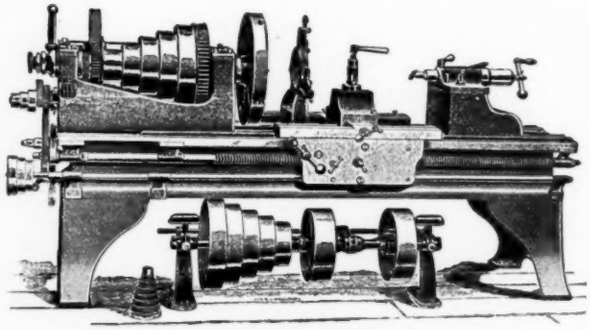

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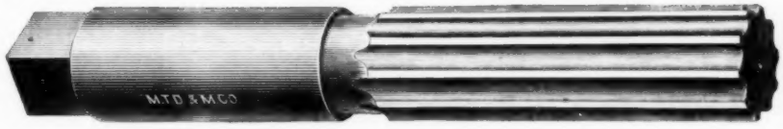

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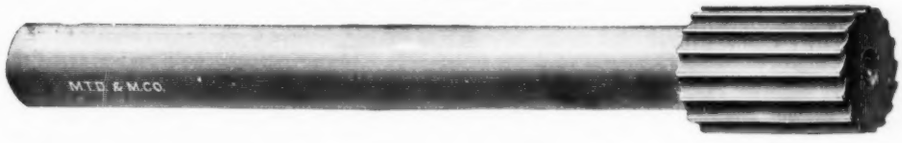

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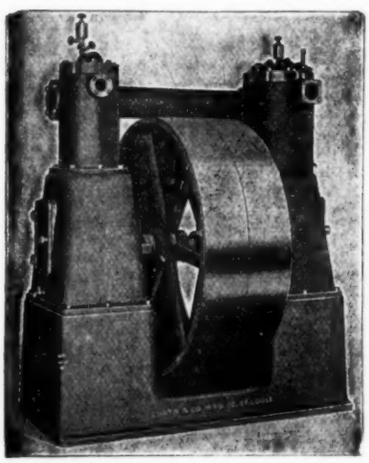

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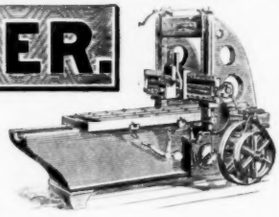

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Planers only! Nothing but Planers!!

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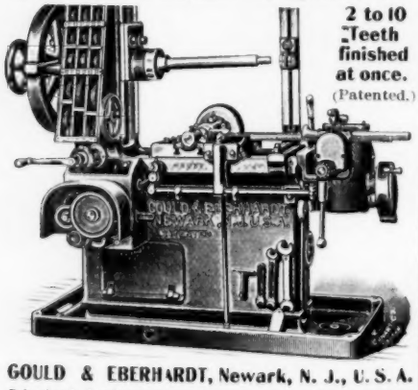

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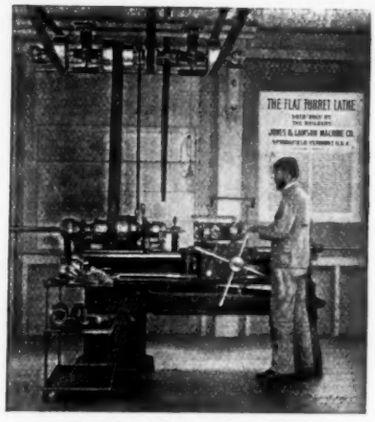

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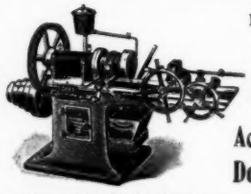

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